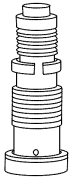
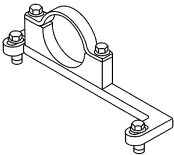
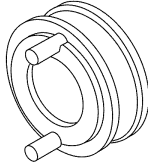
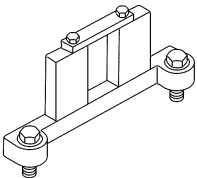
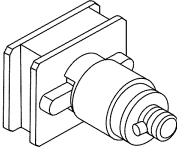
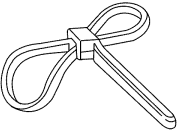


ASSEMBLY

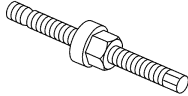
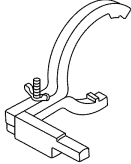
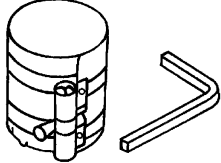
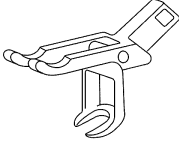
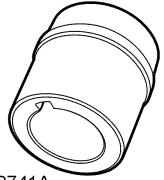
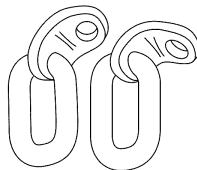
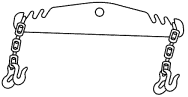
Engine

Special Tool(s)

 <p>ST1774-A</p>	<p>Tensioner, Timing Chain 303-571 (T97T-6K254-A)</p>
 <p>ST1777-A</p>	<p>Holding Tool, Camshaft Sprocket 303-564 (T97T-6256-B)</p>
 <p>ST1776-A</p>	<p>Adapter for 303-564 303-578 (T97T-6256-A)</p>
 <p>ST1778-A</p>	<p>Holding Tool, Camshaft 303-577 (T97T-6256-C)</p>
 <p>ST1779-A</p>	<p>Adapter for 303-577 303-576 (T97T-6256-D)</p>
 <p>ST1438-A</p>	<p>Strap Wrench 303-D055 (85L-6000-A) or equivalent</p>

(Continued)

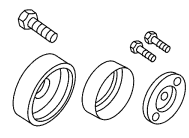
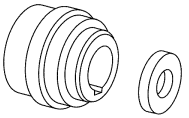
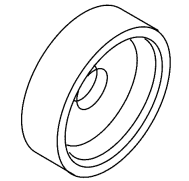
Special Tool(s)

 <p>ST1287-A</p>	<p>Installer, Crankshaft Vibration Damper 303-102 (T74P-6316-B)</p>
 <p>ST1775-A</p>	<p>Timing Tool, Crankshaft TDC 303-573 (T97T-6303-A)</p>
	<p>Compressor, Piston Ring 303-D032 (D81L-6002-C)</p>
 <p>ST1330-A</p>	<p>Compressor, Valve Spring 303-581 (T97T-6565-A)</p>
 <p>ST2741A</p>	<p>Crankshaft Socket 303-674</p>
 <p>ST1831-A</p>	<p>Lifting Eyes 303-050</p>
 <p>ST1602-A</p>	<p>Spreader Bar 303-D089 (D93P-6001-A3) or equivalent</p>

(Continued)

ASSEMBLY (Continued)

Special Tool(s)

 <p>ST1785-A</p>	<p>Service Set, Crankshaft Rear Oil Seal 303-S524 (T95T-6701-AR)</p>
 <p>ST2439-A</p>	<p>Aligner, Front Cover 303-093 (T74P-6019-A)</p>
 <p>ST2132-A</p>	<p>Installer, Crankshaft Rear Oil Seal 303-579 (T97T-6701-A)</p>

Material

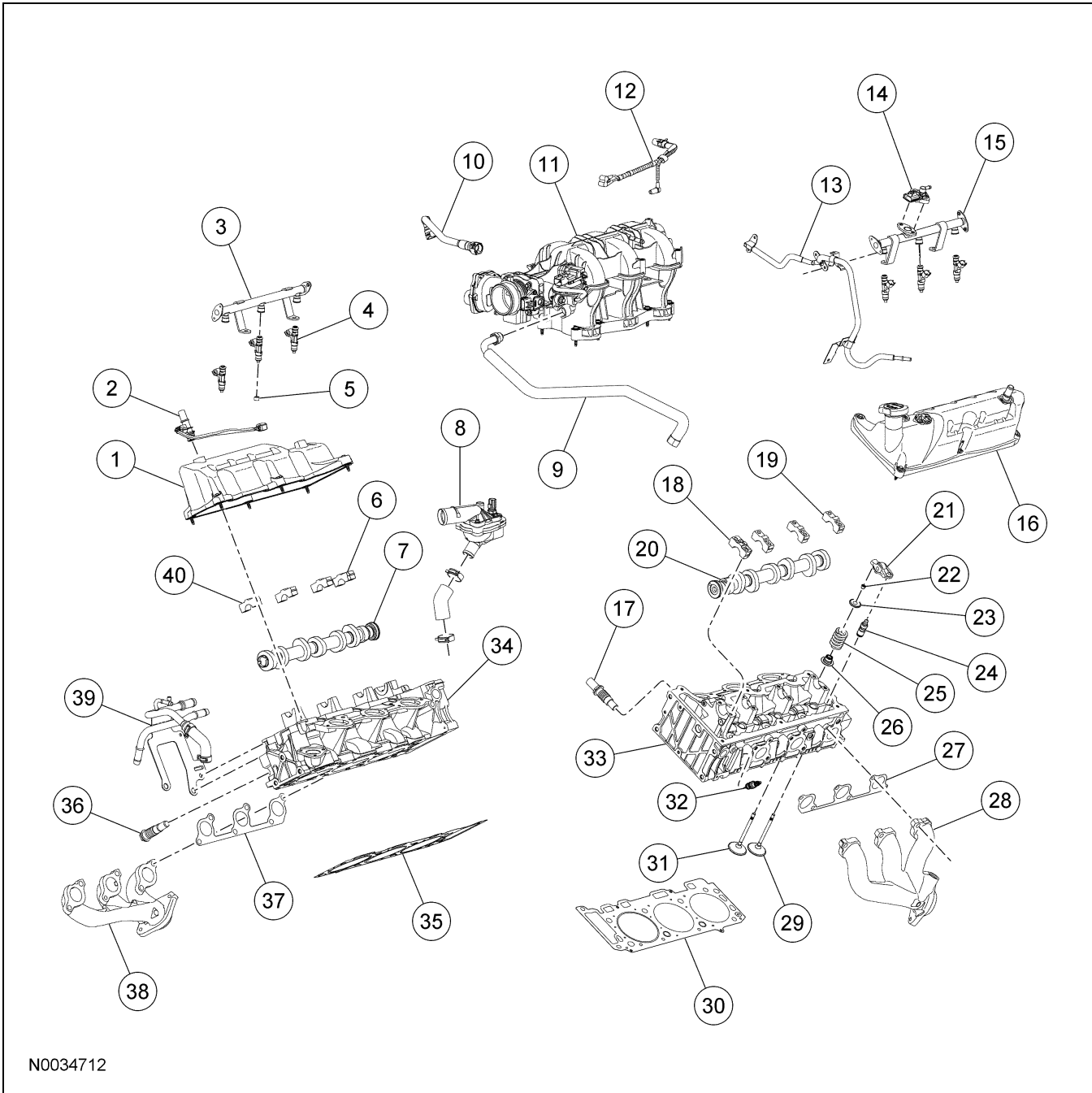
Item	Specification
Motorcraft Metal Surface Prep ZC-31	—
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4
Silicone Brake Caliper Grease and Dielectric Compound XG-3-A	ESE-M1C171-A
Thread Sealant with PTFE TA-24	WSK-M2G350-A2

Material

Item	Specification
Motorcraft SAE 5W-30 Premium Synthetic Blend Motor XO-5W30-QSP (in Canada Motorcraft SAE 5W-30 Super Premium Motor Oil CXO-5W30-LSP12) or equivalent	WSS-M2C929-A
Silicone Gasket Remover ZC-30	—

(Continued)

ASSEMBLY (Continued)



N0034712

Item	Part Number	Description
1	6582	RH valve cover
2	6769	Electric positive crankcase ventilation (PCV) valve
3	9D280	RH fuel rail
4	9F593	Fuel injector (6 required)
5	9G512	Fuel injector insert adapter (6 required)
6	6A258	RH camshaft thrust bearing cap
7	6250	RH camshaft

(Continued)

Item	Part Number	Description
8	8A586	Thermostat housing
9	9E469	Exhaust gas recirculation (EGR) system module tube
10	6K817	PCV tube
11	9K479	Intake manifold
12	9E498	Vacuum harness
13	9E964	Fuel supply tube
14	9G756	Fuel rail pressure and temperature sensor
15	9D280	LH fuel rail

(Continued)

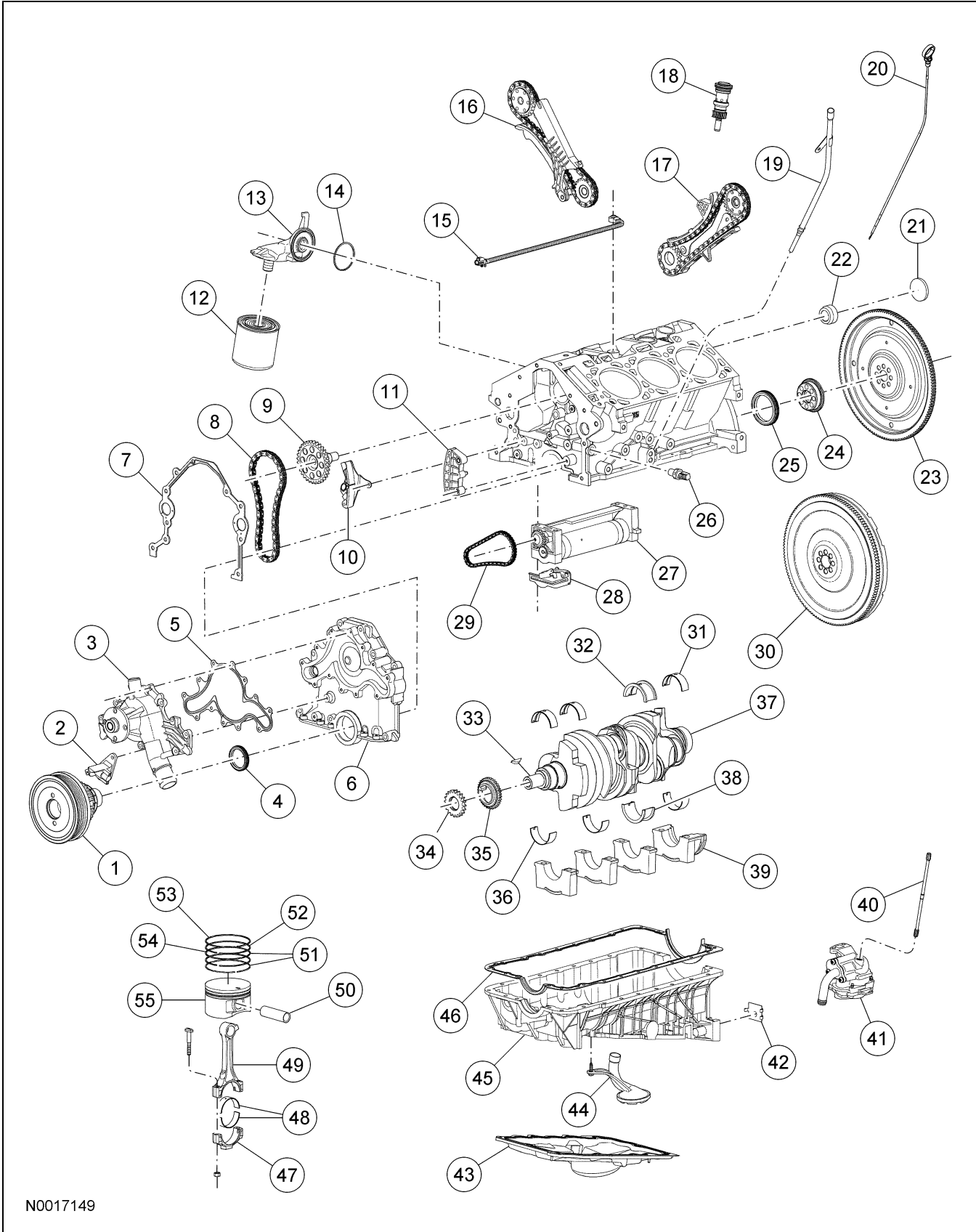
ASSEMBLY (Continued)

Item	Part Number	Description
16	6A505	LH valve cover
17	6K254	LH hydraulic chain tensioner
18	6A258	LH camshaft thrust bearing cap
19	6A258	LH camshaft bearing cap (3 required)
20	6A274	LH camshaft
21	6529	Roller follower (12 required)
22	6518	Valve spring retainer keys (12 required)
23	6A536	Valve spring retainer (12 required)
24	6C501	Hydraulic lash adjuster (12 required)
25	6513	Valve spring (12 required)
26	6571	Valve stem seal (12 required)

(Continued)

Item	Part Number	Description
27	9448	LH exhaust manifold gasket
28	9431	LH exhaust manifold
29	6507	Intake valve (6 required)
30	6083	LH cylinder head gasket
31	6505	Exhaust valve (6 required)
32	12405	Spark plug (6 required)
33	6049	LH cylinder head
34	6049	RH cylinder head
35	6051	RH cylinder head gasket
36	6K254	RH hydraulic chain tensioner
37	9448	RH exhaust manifold gasket
38	9430	RH exhaust manifold
39	18696	Coolant tube
40	6A258	RH camshaft bearing cap (3 required)

ASSEMBLY (Continued)



N0017149

ASSEMBLY (Continued)

Item	Part Number	Description
1	6B321	Crankshaft pulley
2	6C315	Crankshaft position (CKP) sensor
3	8501	Coolant pump
4	6700	Crankshaft front oil seal
5	8507	Coolant pump gasket
6	6019	Engine front cover
7	6020	Engine front cover gasket
8	6M270	Jackshaft chain
9	6M264	Jackshaft chain sprocket
10	6M271	Jackshaft chain tensioner
11	6M272	Jackshaft chain guide
12	6714	Oil filter
13	6884	Oil filter adapter
14	6L621	Oil filter adapter O-ring seal
15	12A699	Knock sensor (KS)
16	6M290	RH camshaft drive cassette
17	6M289	LH camshaft drive cassette
18	6846	Oil pump drive assembly
19	6754	Oil level indicator tube
20	6750	Oil level indicator
21	6M296	Jackshaft seal
22	6M052	Jackshaft plug
23	6375	Flexplate
24	6434	Flexplate-to-crankshaft spacer
25	6701	Crankshaft rear oil seal
26	9278	Oil pressure sensor
27	6A311	Balance shaft (if equipped)
28	6K355	Balance shaft chain tensioner (if equipped)
29	6A364	Balance shaft chain (if equipped)
30	6375	Flywheel (manual transmission only)
31	6333	Crankshaft main bearing (3 required)
32	6337	Crankshaft main bearing cap
33	W702979	Woodruff key
34	6306	Jackshaft chain sprocket
35	6K350	Balance shaft chain sprocket (if equipped)

(Continued)

Item	Part Number	Description
36	6A338	Crankshaft main bearing (3 required)
37	6303	Crankshaft
38	6A339	Crankshaft main bearing cap
39	6325	Crankshaft main thrust bearing
40	6A605	Oil pump drive shaft
41	6621	Oil pump
42	6C629	Shim (2 required)
43	6675	Oil pan
44	6617	Oil pump screen and pickup tube
45	6F092	Cylinder block cradle
46	6710	Cylinder block cradle gasket
47	6210	Connecting rod cap
48	6211	Connecting rod bearings
49	6200	Connecting rod
50	6135	Piston pin
51	6159	Oil control rings
52	6152	Lower compression ring
53	6150	Upper compression ring
54	6161	Oil control ring spacer
55	6110	Piston

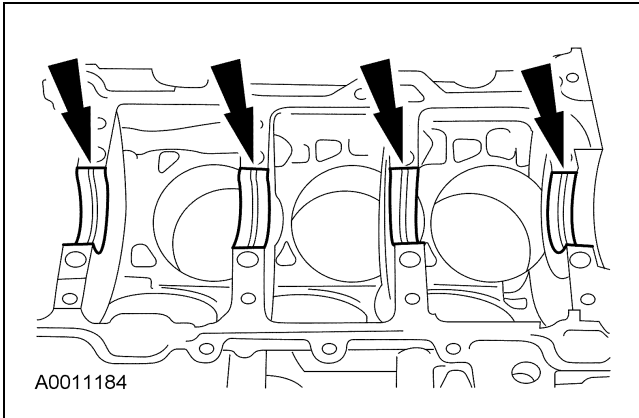
⚠ CAUTION: During engine repair procedures, cleanliness is extremely important. Any foreign material, including any material created while cleaning gasket surfaces that enters the oil passages, coolant passages or the oil pan, can cause engine failure.

⚠ CAUTION: If the fuel rail is used as a leverage device, damage may occur to the fuel rail. Care must be taken when working around the fuel rail.

1. Install the crankshaft main bearings and the thrust bearing.
 - Lubricate the crankshaft main bearings with clean engine oil.

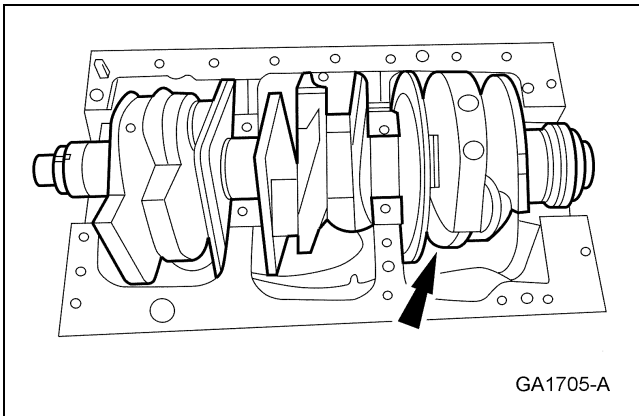
ASSEMBLY (Continued)

2. Install the lower main bearings in the bearing caps.



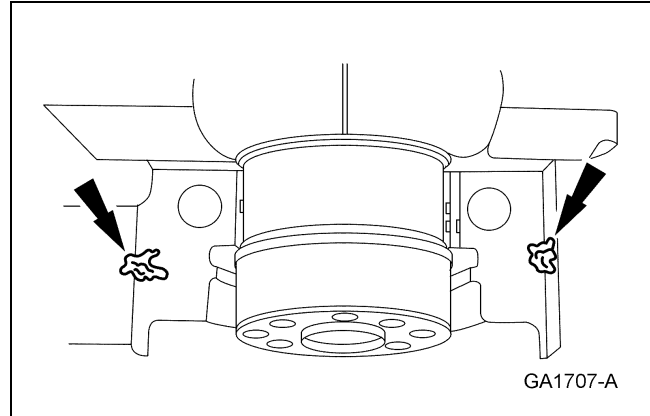
3. **NOTE:** The crankshaft main bearings are precision selective fit. Inspect the bearing clearance. For additional information, refer to Section 303-00.

Install the crankshaft.

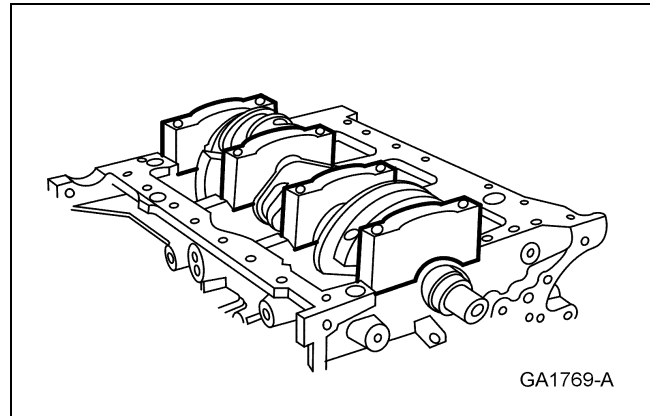


4. **NOTE:** If not secured within 4 minutes, the sealant must be removed and the sealing area cleaned. To clean the sealing area, use silicone gasket remover and metal surface prep. Follow the directions on the packaging. Failure to follow this procedure can cause future oil leakage.

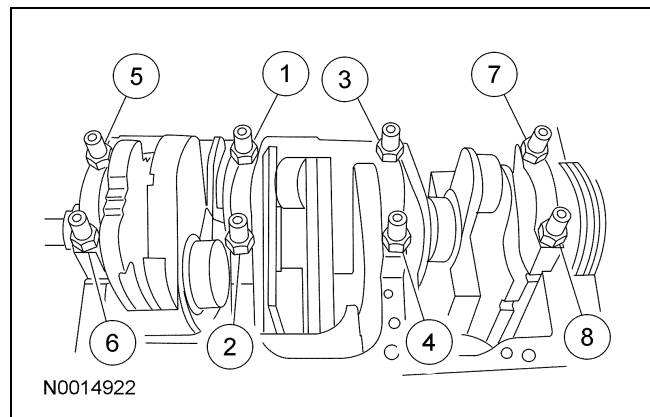
Apply silicone gasket and sealant to the rear main bearing cap to cylinder block parting line.



5. Install the main bearing caps in the order in which they were removed.



6. Tighten the bolts in the sequence shown to 35 Nm (26 lb-ft) and then rotate an additional 57 degrees.

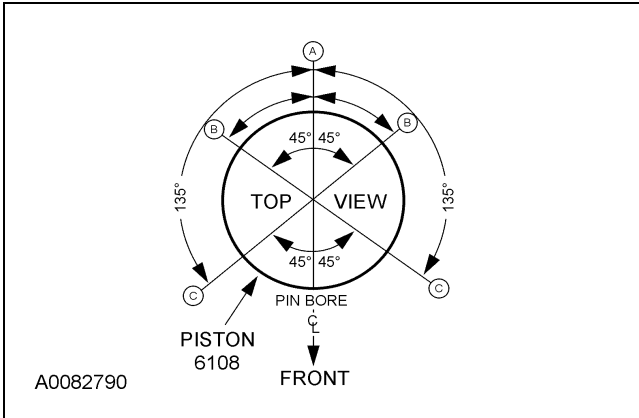


7. Check the piston to cylinder bore and ring clearance. For additional information, refer to Section 303-00.

ASSEMBLY (Continued)

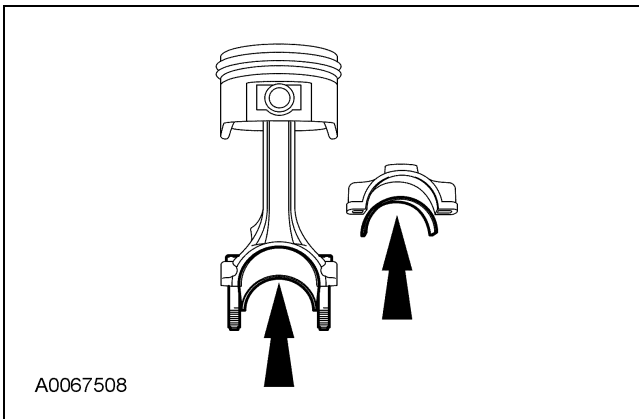
8. **NOTE:** Lubricate the piston rings with clean engine oil.
Install the piston rings.

9. Make sure the ring gaps (oil spacer-A, oil ring-B, compression ring-C) are correctly spaced around the circumference of the piston.



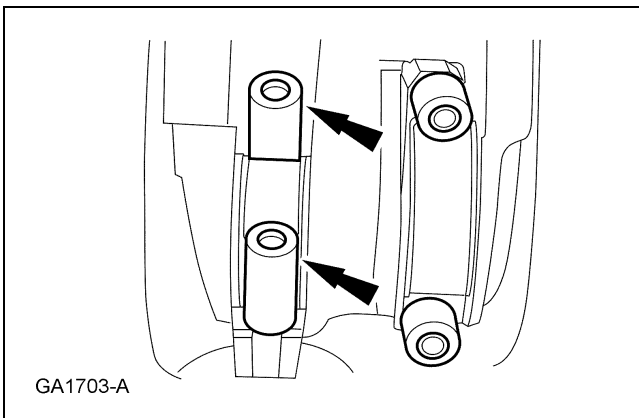
A0082790

10. Install the connecting rod bearings.



A0067508

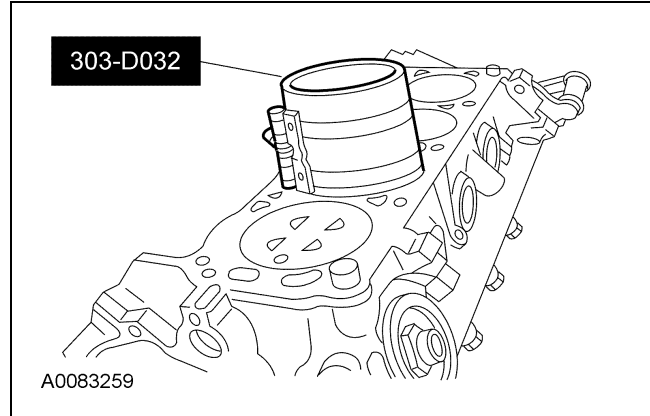
11. Install rubber hose pieces on the connecting rod bolts to protect the crankshaft.



GA1703-A

12. **NOTE:** Position the piston with the indentation arrow toward the front of the cylinder block.
Using the special tool, install the pistons.

- Rotate the crankshaft as necessary.



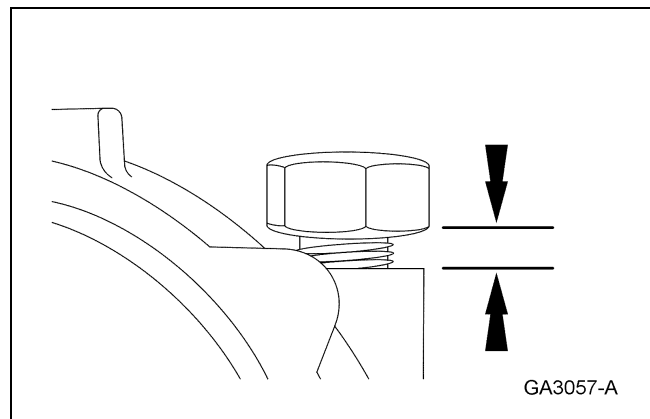
13. **NOTE:** The old nuts and bolts are used for checking clearances. New nuts and bolts must be used for reassembly.

Check the clearance of each connecting rod bearing. For additional information, refer to Section 303-00.

14. Rotate the crankshaft until the piston is at the bottom of its stroke.

15. **NOTE:** For cylinders 1, 2 and 3, remove the connecting rod nut at the oil split hole side first. For cylinders 4, 5 and 6, remove the opposite nut first.

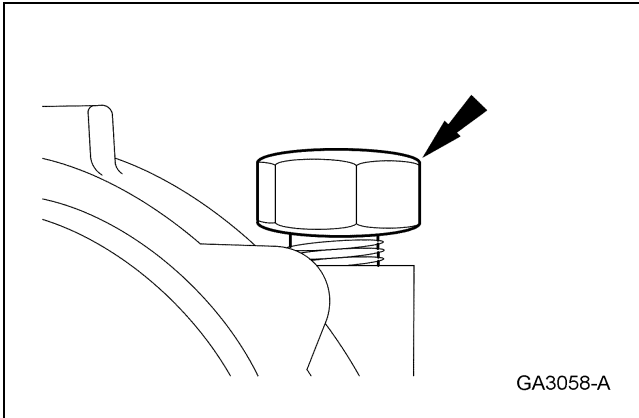
Loosen the first nut until the face is approximately 2 mm (0.08 in) over the end of the bolt.



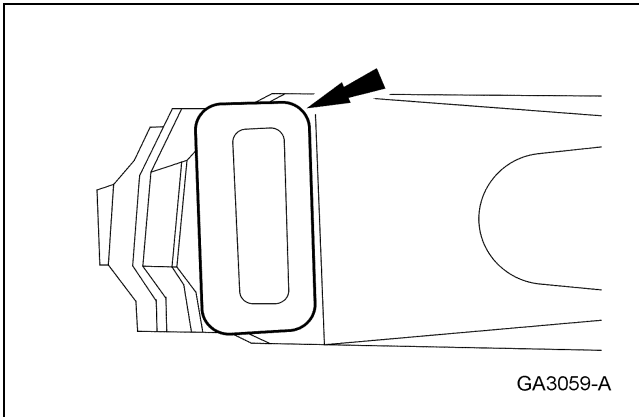
GA3057-A

ASSEMBLY (Continued)

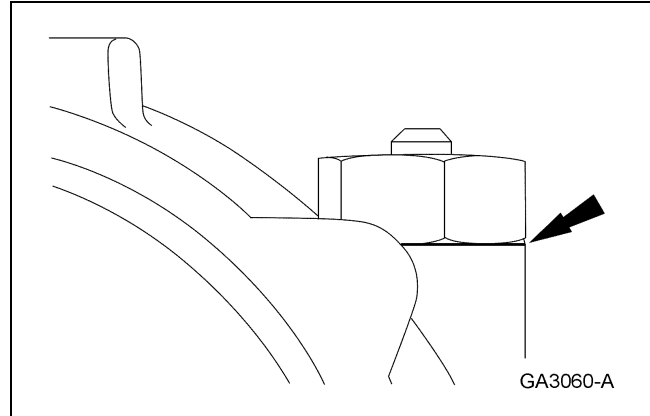
16. Tap on the nut until the bolt can be removed by hand.



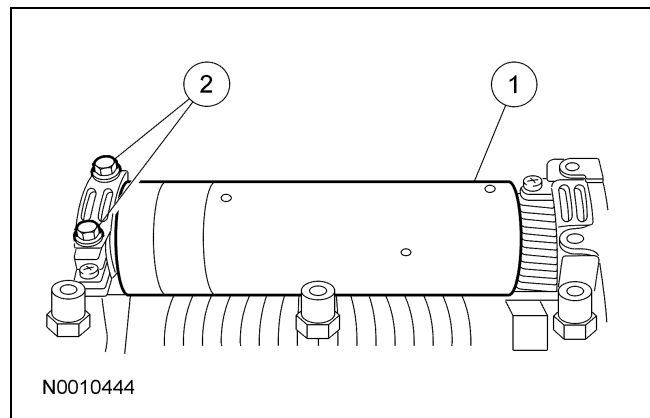
17. Repeat the previous 2 steps for the opposite bolt.
18. Install the new bolts making certain that the bolt head is parallel to the sideward face of the connecting rod.



19. Install the connecting rod cap in its original position.
20. Install and tighten the connecting rod nuts finger-tight.



21. Tighten the connecting rod nuts simultaneously in 2 stages:
- Stage 1: Tighten to 20 Nm (15 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.
22. Repeat the previous 4 steps for the remaining connecting rods.
23. Rotate crankshaft until the No. 1 piston is at top dead center.
24. If equipped, install the balance shaft.
- 1 Position the balance shaft assembly.
 - 2 Install the bolts and tighten to 27 Nm (20 lb-ft).

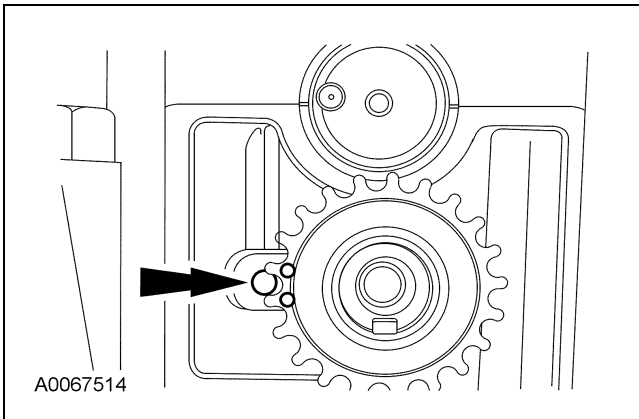


ASSEMBLY (Continued)

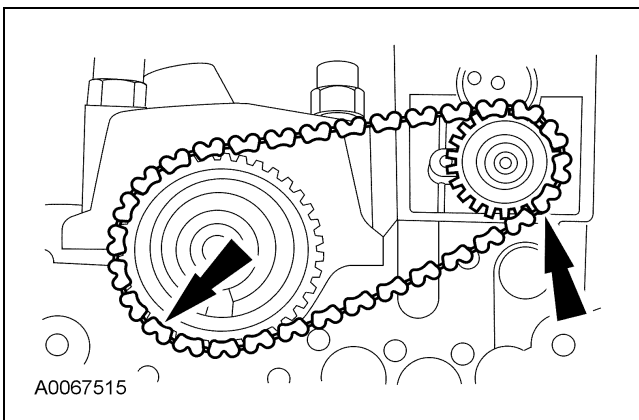
25. **NOTE:** Due to the gear ratio between the reversal shaft and the balance shaft, up to 7 complete turns of the balance shaft may be required to find the correct position.

Align the timing marks.

- Install a 4 mm (0.16 in) pin to hold the shaft in place.

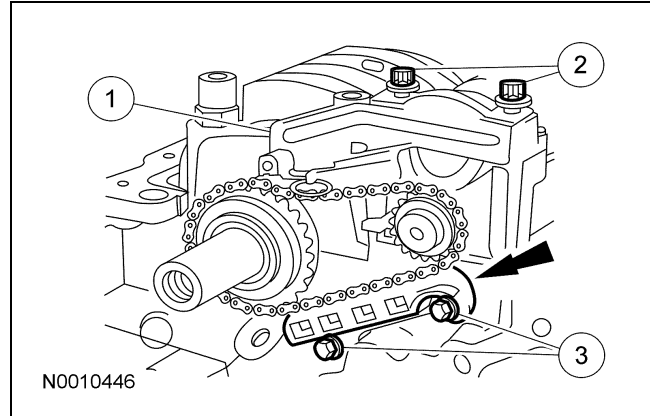


26. If equipped, install the balance shaft chain and crankshaft sprocket.



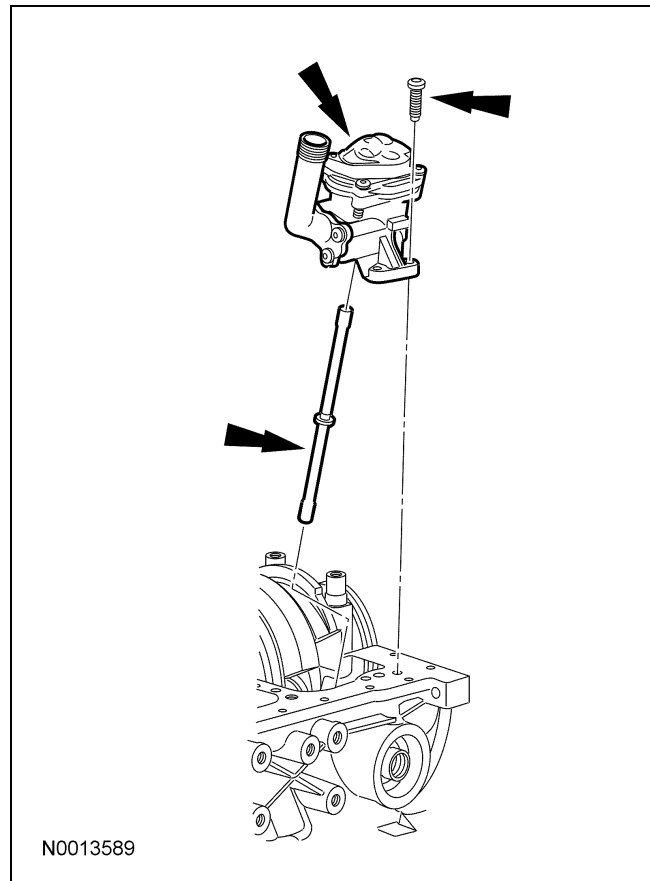
27. If equipped, install the balance shaft tensioner.

- 1 Position the balance shaft tensioner.
 - 2 Install the 2 bolts and tighten to 29 Nm (21 lb-ft).
 - 3 Position the balance shaft chain guide, install the 2 bolts and tighten to 10 Nm (89 lb-in).
- Remove the pin from the tensioner.



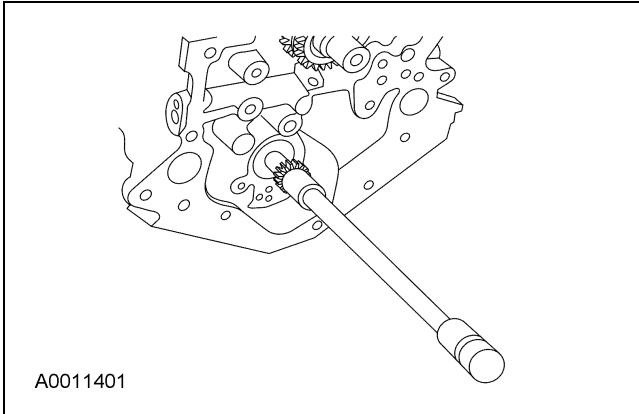
28. Position the oil pump intermediate shaft and the oil pump. Install the 2 bolts.

- Tighten to 19 Nm (14 lb-ft).



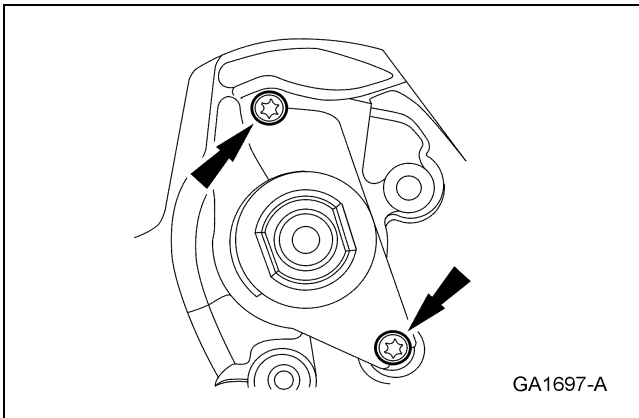
ASSEMBLY (Continued)

29. Install the jackshaft.

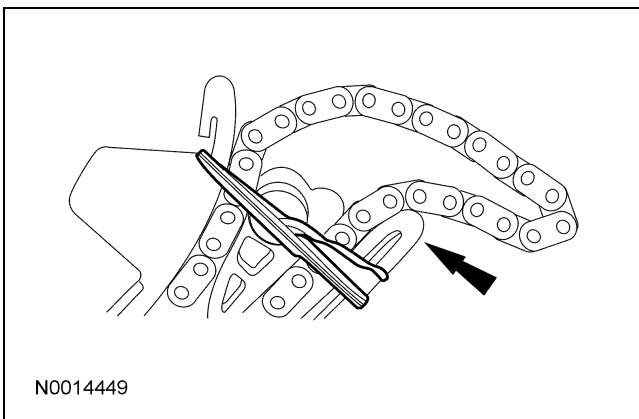


30. Install the jackshaft thrust plate and bolts.

- Tighten to 11 Nm (8 lb-ft).

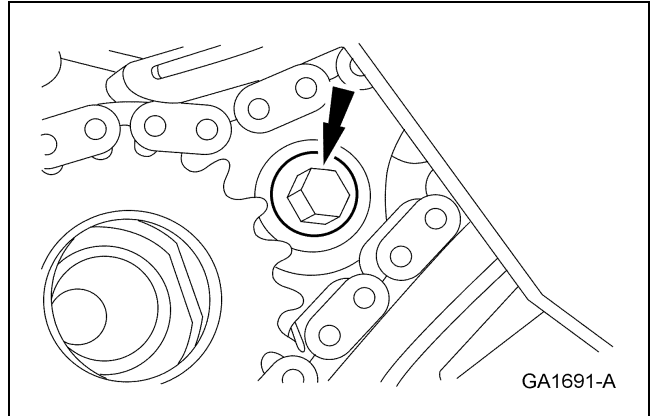


31. Position the LH cassette.

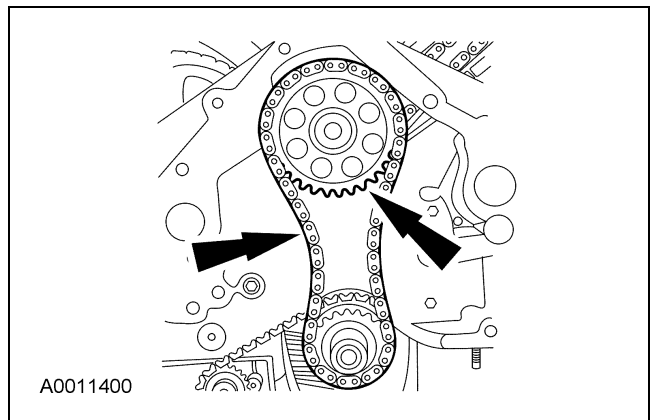


32. Install the front cassette and the bolt.

- Tighten to 19 Nm (14 lb-ft).

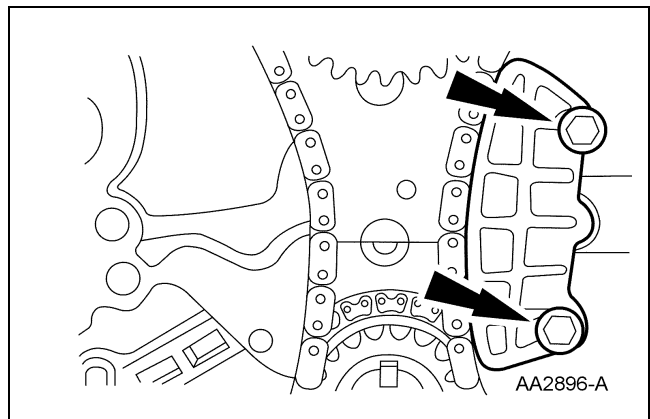


33. Position the jackshaft sprocket and chain.



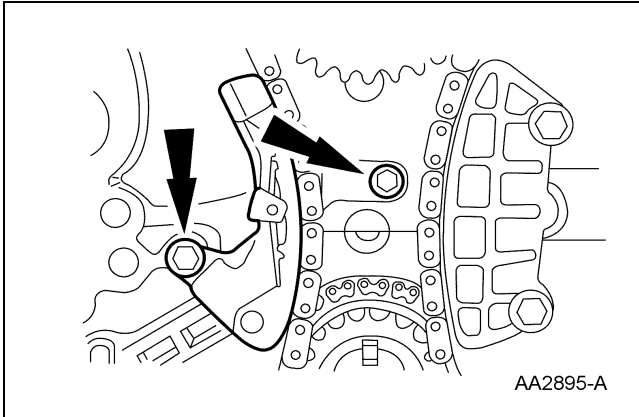
34. Install the jackshaft chain guide and the 2 bolts.

- Tighten to 19 Nm (14 lb-ft).

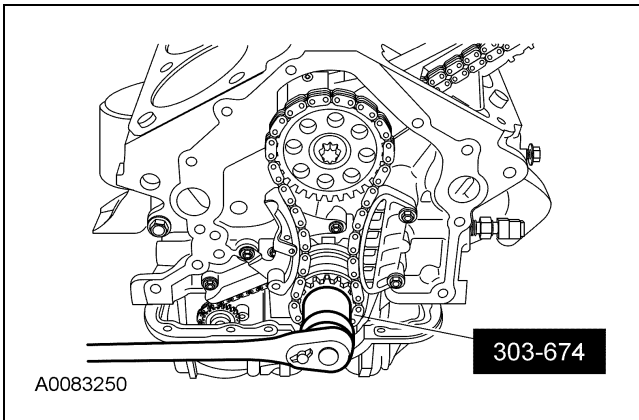


ASSEMBLY (Continued)

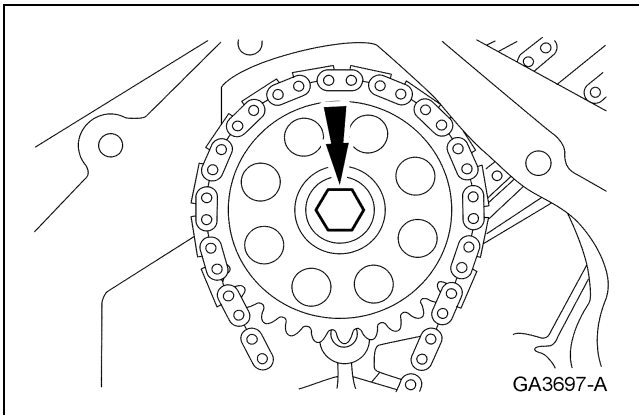
35. Install the jackshaft chain tensioner and the 2 bolts.
- Tighten to 9 Nm (80 lb-in).



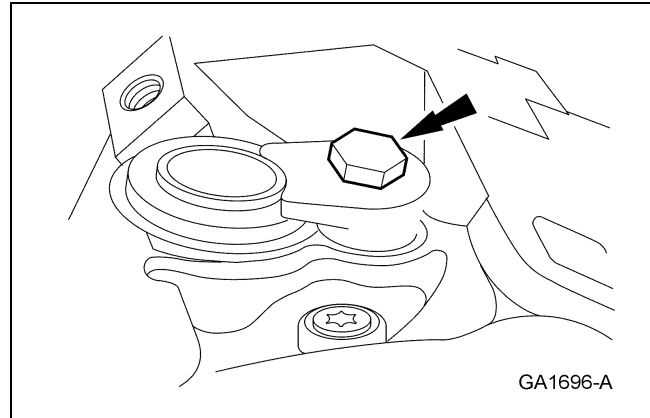
36. Using the special tool, hold the crankshaft.



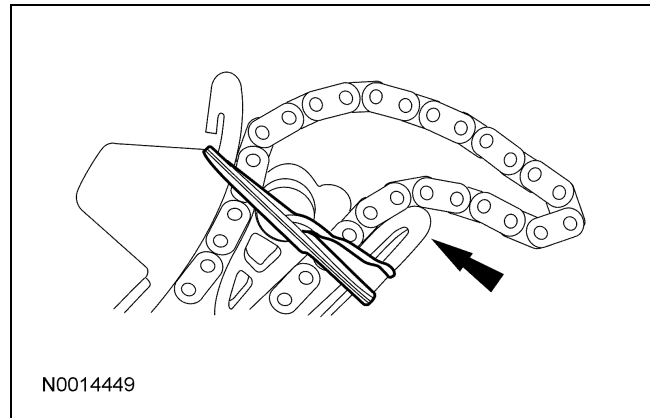
37. Install the jackshaft sprocket bolt and tighten in 2 stages.
- Stage 1: Tighten to 45 Nm (33 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.



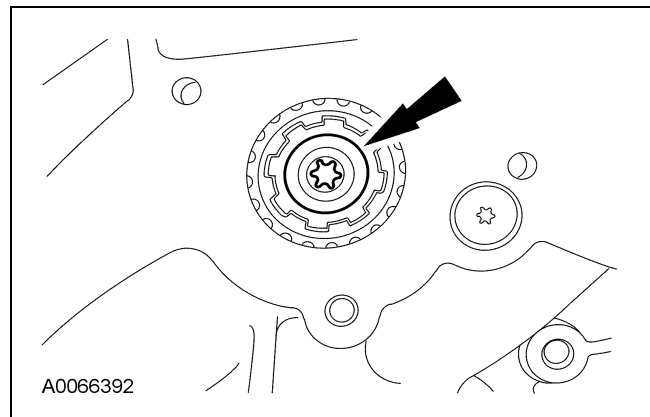
38. Install the oil pump drive and the bolt.
- Tighten to 19 Nm (14 lb-ft).



39. Position the RH cassette.



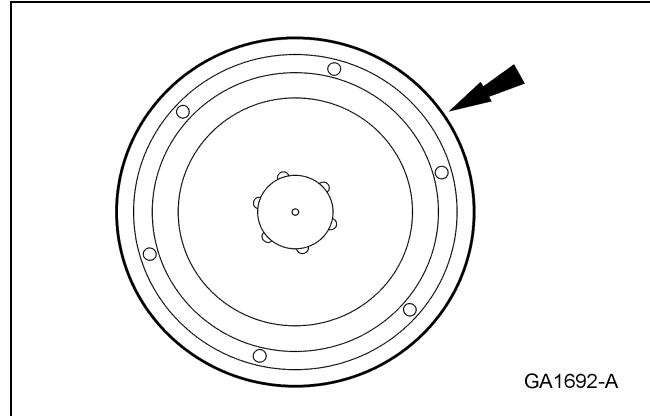
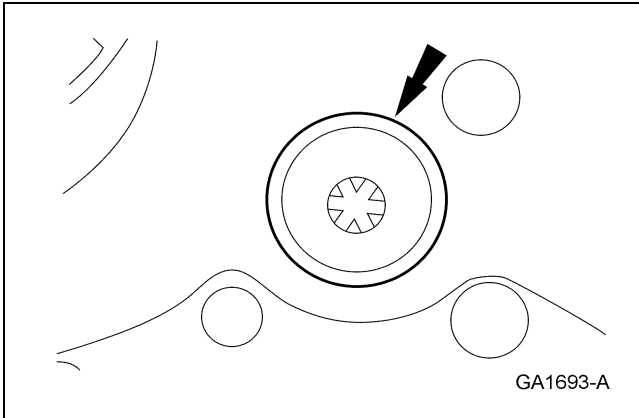
40. Position the rear jackshaft sprocket and the spacer on the jackshaft.
- Loosely install the bolt.



ASSEMBLY (Continued)

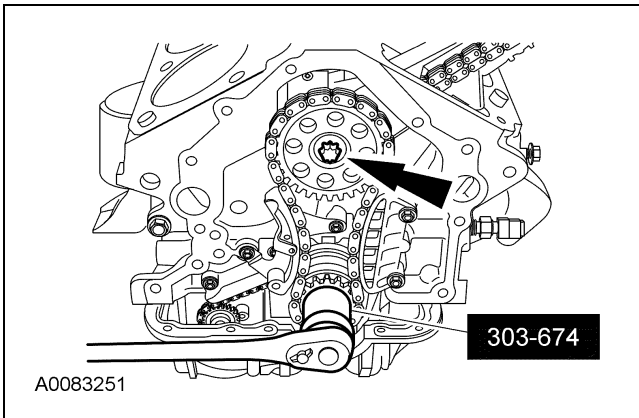
41. Install the RH cassette bolt.

- Tighten to 12 Nm (9 lb-ft).



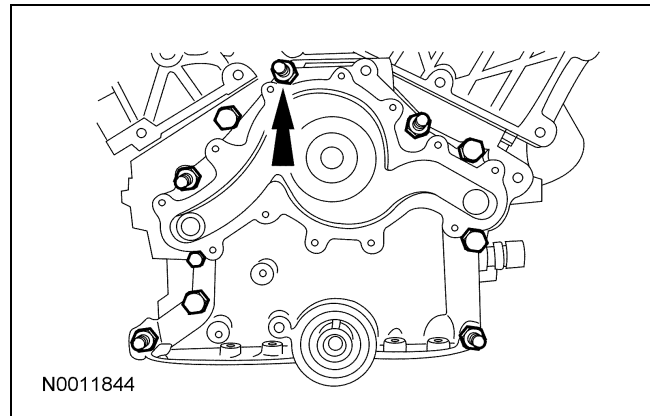
45. Position a new engine front cover gasket on the cylinder block.

42. Using the special tool, hold the crankshaft.



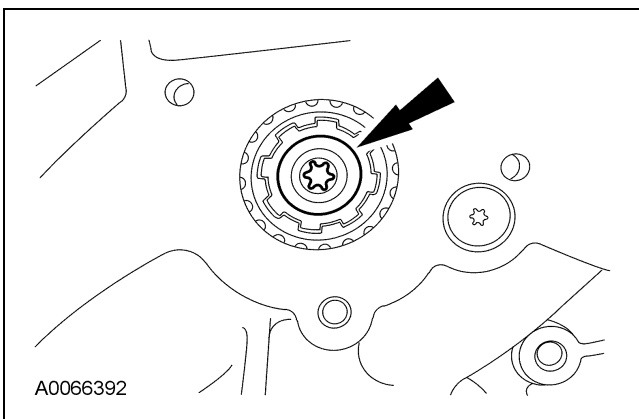
46. **NOTE:** Apply thread sealant to the stud bolts and make sure that the stud bolts are installed in their original positions.

Position the front cover and loosely install the 5 bolts and the 5 stud bolts.

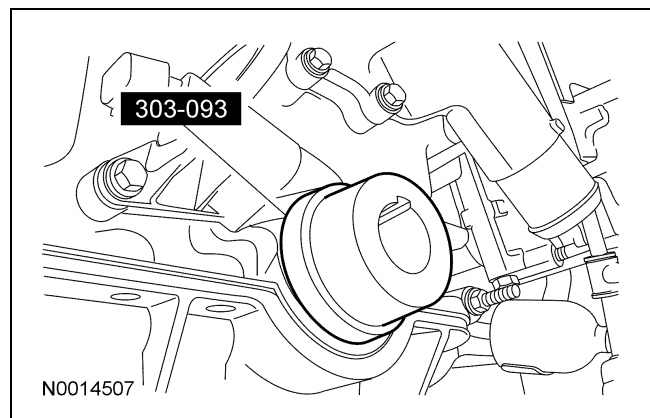


43. Tighten the rear jackshaft sprocket bolt in 2 stages.

- Stage 1: Tighten to 20 Nm (15 lb-ft).
- Stage 2: Tighten an additional 90 degrees.



47. Use the special tool to align the front cover and tighten the bolts and stud bolts to 19 Nm (14 lb-ft).

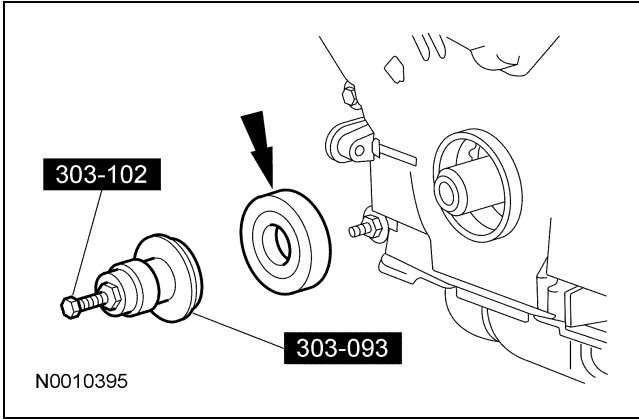


44. Install the jackshaft plug.

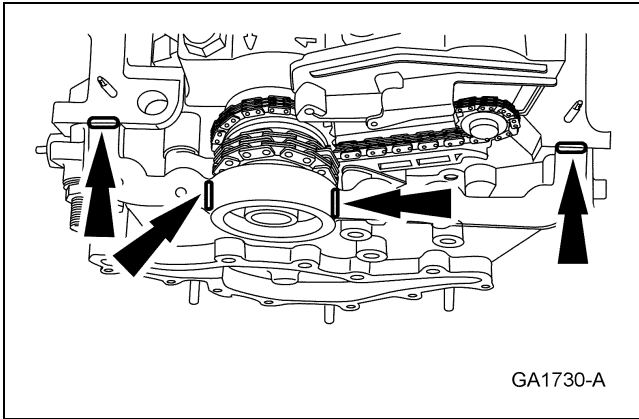
ASSEMBLY (Continued)

48. **NOTE:** Lubricate the seal lip with clean engine oil.

Using the special tools, install the crankshaft front oil seal.

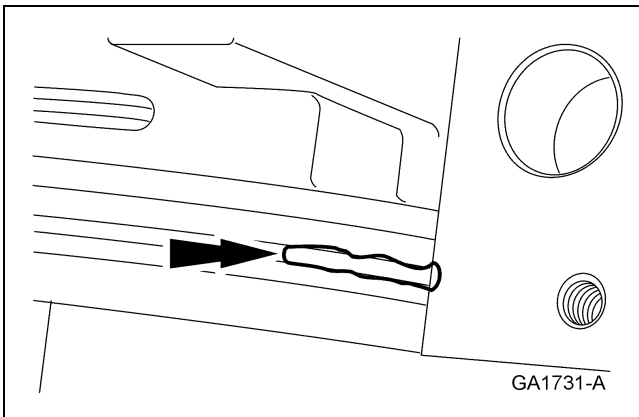


49. Apply silicone gasket and sealant to the front cover in 4 places.



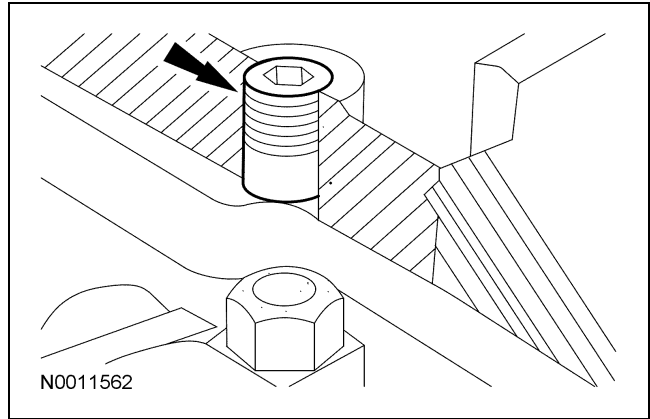
50. Apply silicone gasket and sealant to the rear main bearing cap as shown.

- Position the lower block cradle gasket.

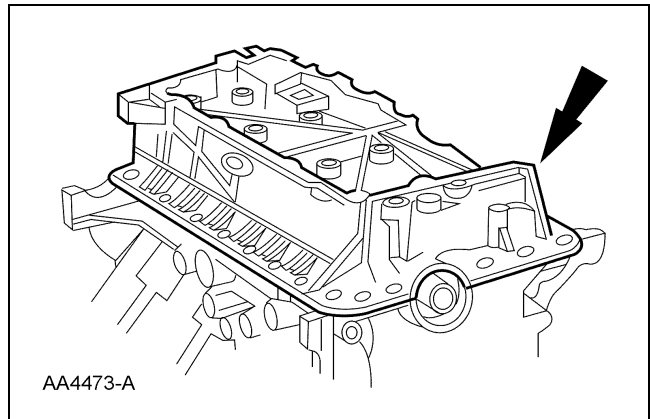


51. **⚠ CAUTION:** Failure to back off the set screws can result in damage to the cylinder block cradle.

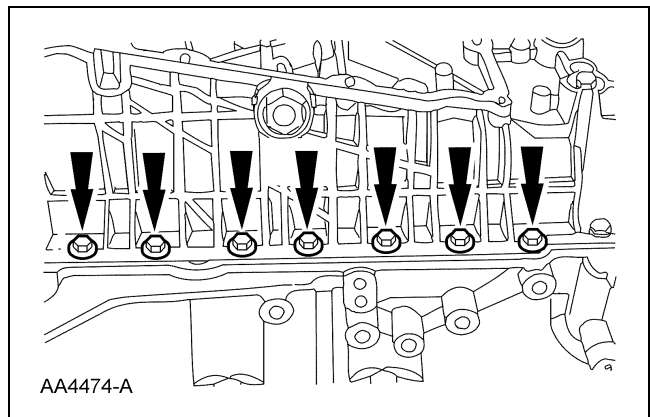
Back the set screws off until they are below the cylinder block cradle boss.



52. Position the lower block cradle and a new gasket.

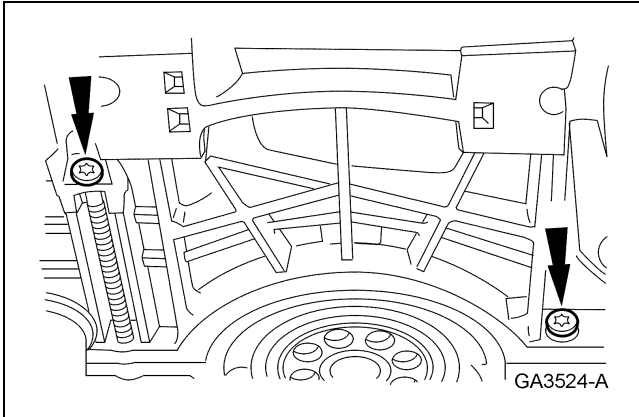


53. Install and hand-tighten the 20 bolts and 2 nuts.



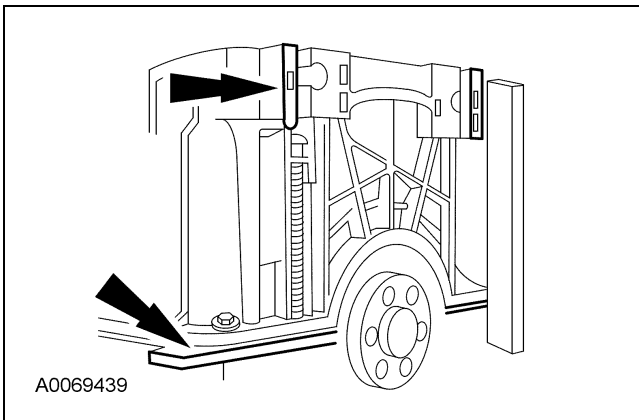
ASSEMBLY (Continued)

54. Install and hand-tighten the bolts.



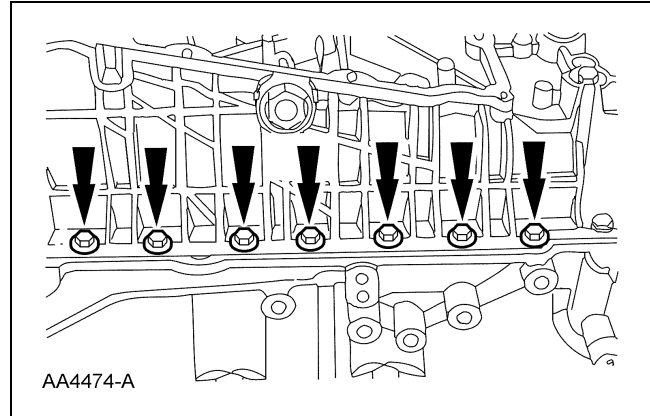
55. **NOTE:** The lower block cradle to the cylinder block alignment must be within a maximum mismatch of 0.25 mm (0.01 in) lower block cradle underflush or 0.05 mm (0.00196 in) lower block cradle protrusion.

Using a straightedge, align the transmission face of the lower block cradle with the rear face of the cylinder block.



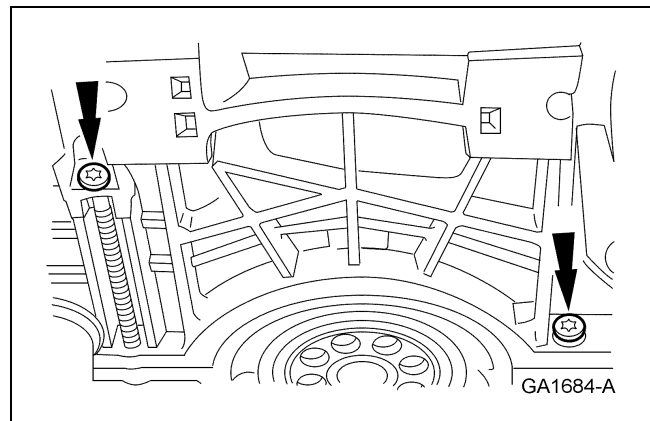
56. Tighten the 20 bolts and the 2 nuts.

- Tighten the bolts with washers and both nuts to 10 Nm (89 lb-in).
- Tighten the bolts without washers to 14 Nm (10 lb-ft).

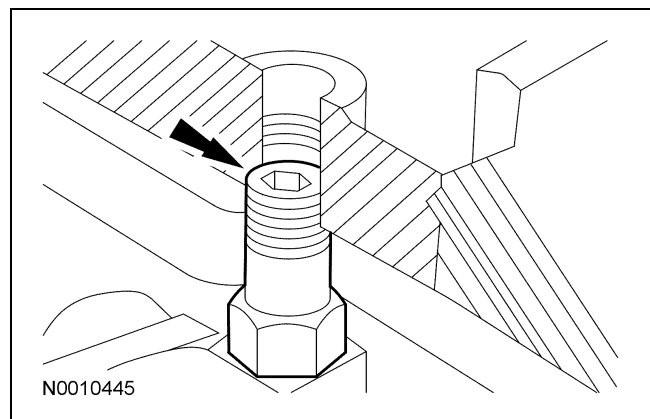


57. Install the 2 block cradle bolts.

- Tighten to 10 Nm (89 lb-in).

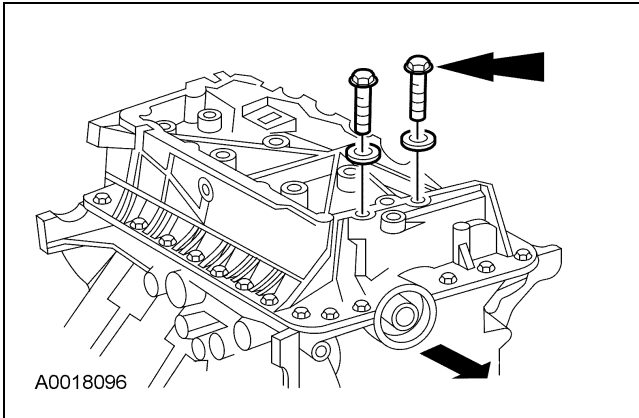


58. Tighten the lower block cradle inserts to 3 Nm (27 lb-in).

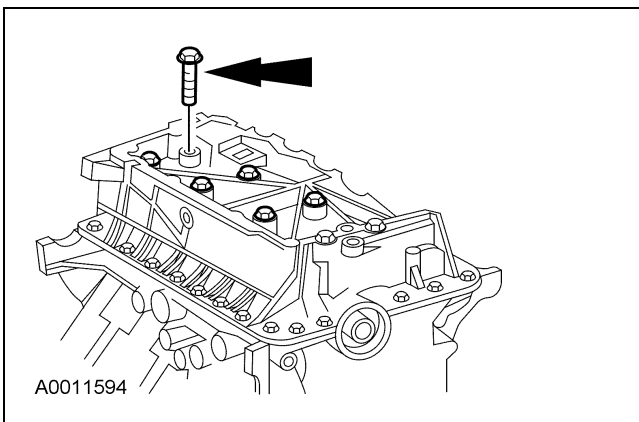


ASSEMBLY (Continued)

59. Install new seals on the 2 silver bolts and loosely install them in the cylinder block cradle.

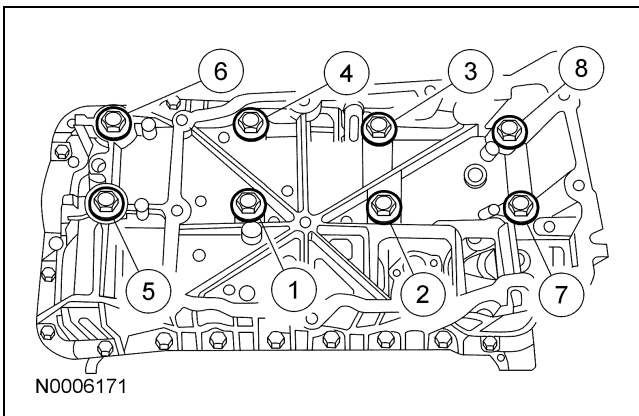


60. Loosely install the 6 remaining lower block cradle bolts.



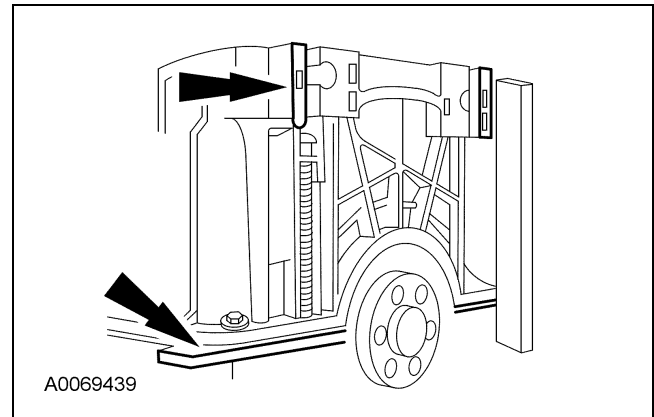
61. Tighten the cylinder block cradle bolts in 2 stages.

- Stage 1: Tighten to 15 Nm (11 lb-ft).
- Stage 2: Tighten to 34 Nm (25 lb-ft).

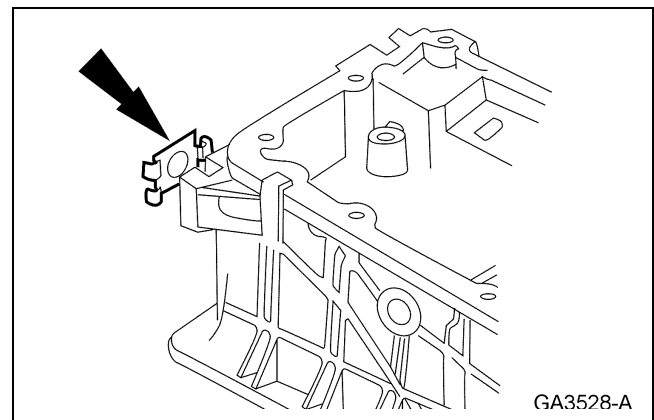


62. **NOTE:** Assemblies that measured out of specification must have the entire assembly procedure repeated.

Measure the step between the rear face of the cylinder block and the transmission face of the lower block cradle.



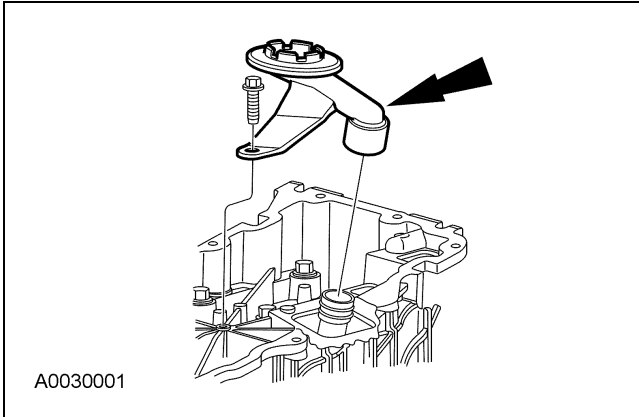
63. Repair all assemblies that exceed underflush specification by installing shims on 1 or both sides of the cylinder block cradle.



ASSEMBLY (Continued)

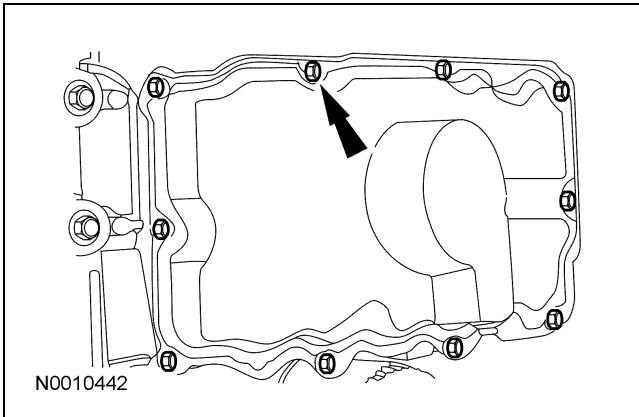
64. Install the oil pump screen and pickup tube and the bolt.

- Tighten to 10 Nm (89 lb-in).

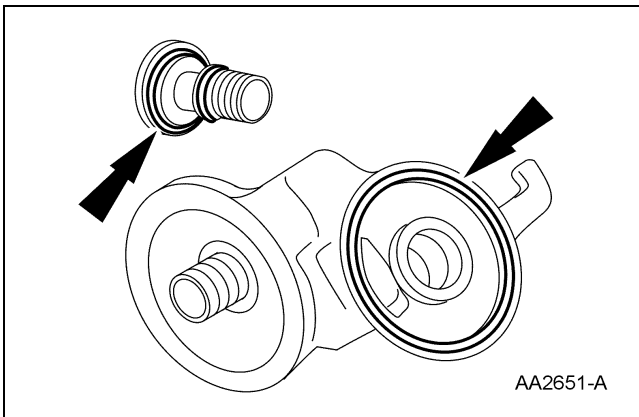


65. Install the gasket, oil pan and the 10 bolts.

- Tighten to 9 Nm (80 lb-in).

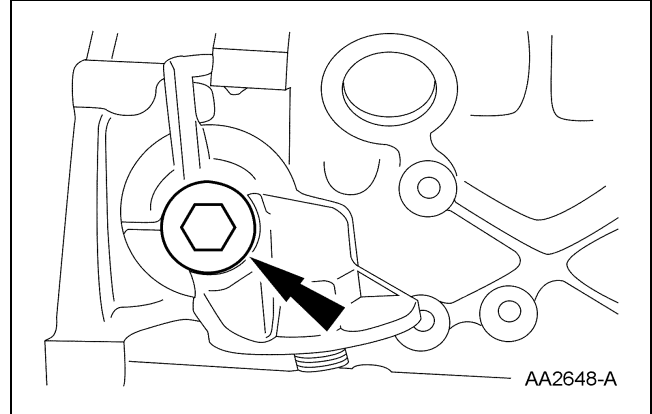


66. Inspect and install new oil filter adapter O-ring seals if necessary.



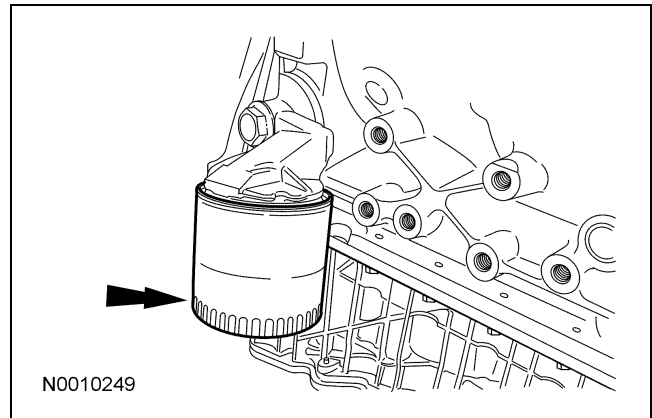
67. Install the oil filter adapter and the bolt.

- Tighten to 57 Nm (42 lb-ft).

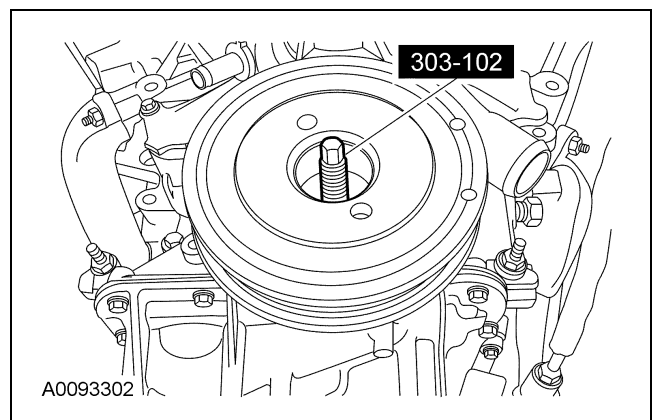


68. Install a new oil filter.


- Tighten until the oil filter seal is flush with the adapter and the tighten an additional 270 degrees.



69. Using the special tool, install the crankshaft pulley.

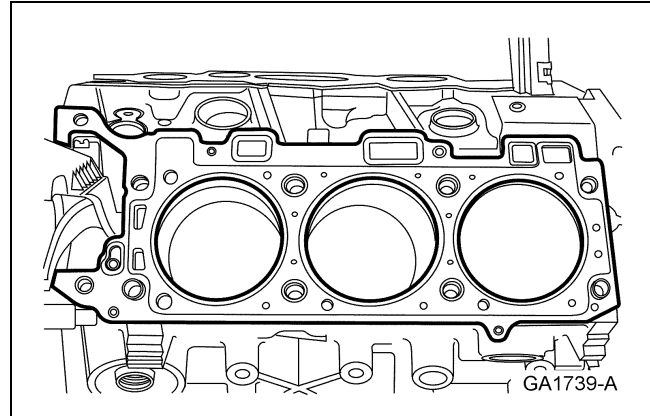
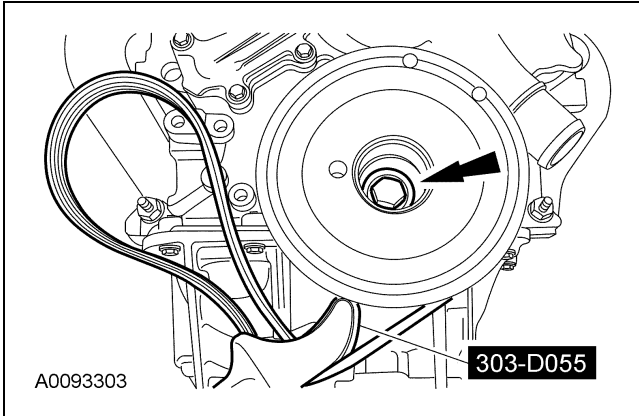



ASSEMBLY (Continued)

70.  **CAUTION:** A new bolt must be used each time it is removed.

Using the special tool, tighten the bolt in 2 stages.

- Stage 1: Tighten to 50 Nm (37 lb-ft).
- Stage 2: Rotate an additional 90 degrees.



73.  **CAUTION:** To avoid damage to the timing chain cassette, an assistant will be required to help position the cylinder head in the vehicle.

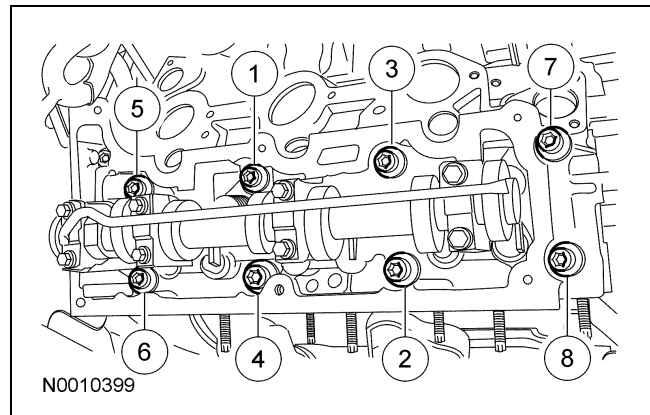
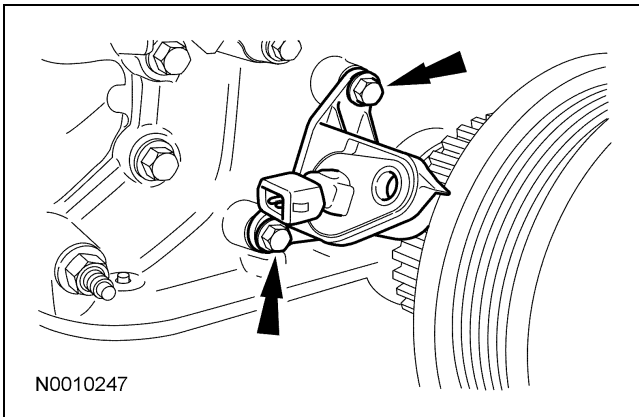
NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

Position the RH cylinder head. Install 8 new M12 bolts and tighten in the sequence shown in 2 stages.

- Stage 1: Tighten to 12 Nm (9 lb-ft).
- Stage 2: Tighten to 25 Nm (18 lb-ft).

71. Position the crankshaft position (CKP) sensor and install the 2 bolts.

- Tighten to 10 Nm (89 lb-in).



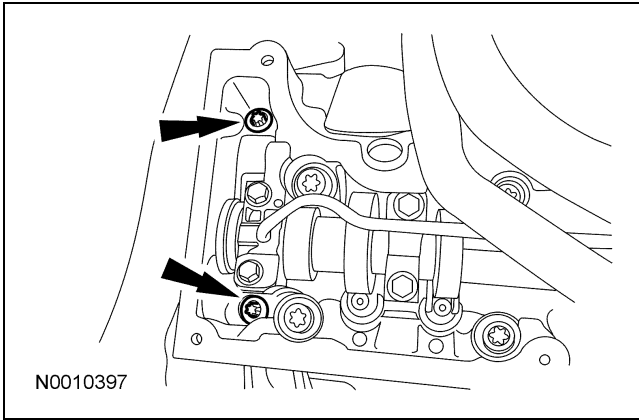
72. **NOTE:** LH side shown, RH side similar.

Position the cylinder head gaskets.

ASSEMBLY (Continued)

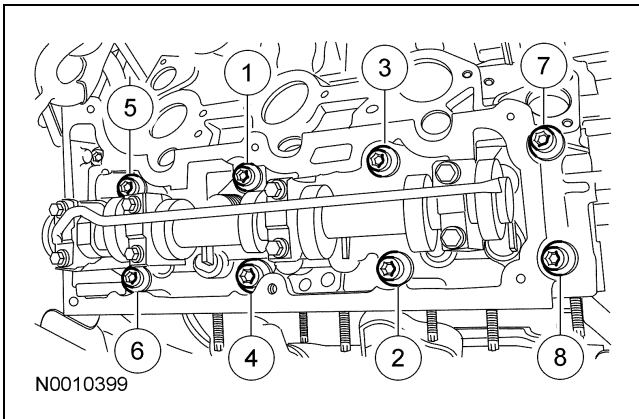
74. Install 2 new M8 bolts.

- Tighten to 32 Nm (24 lb-ft).

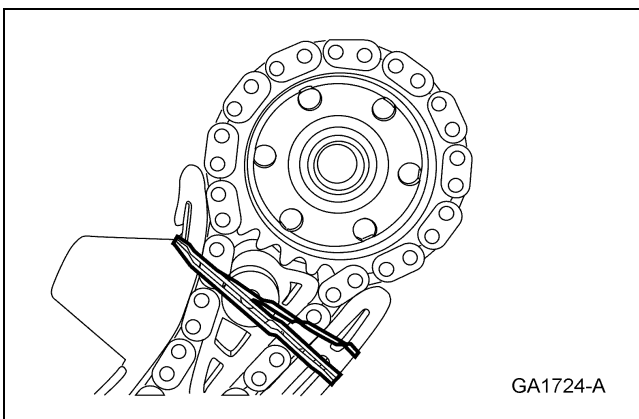


75. Tighten the 8 M12 bolts in the sequence shown in 2 stages.

- Stage 1: Tighten 90 degrees.
- Stage 2: Tighten an additional 90 degrees.

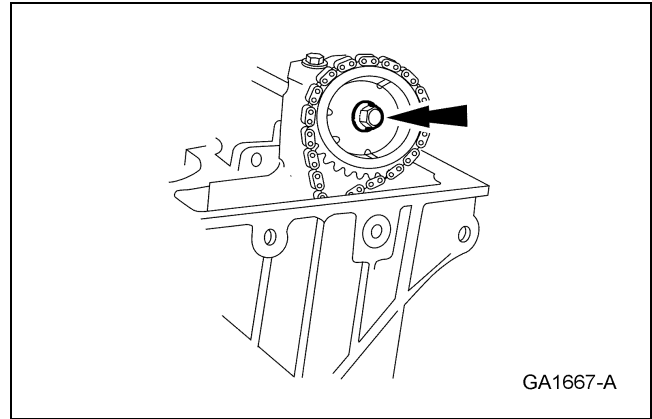


76. Position the RH cassette and camshaft sprocket.



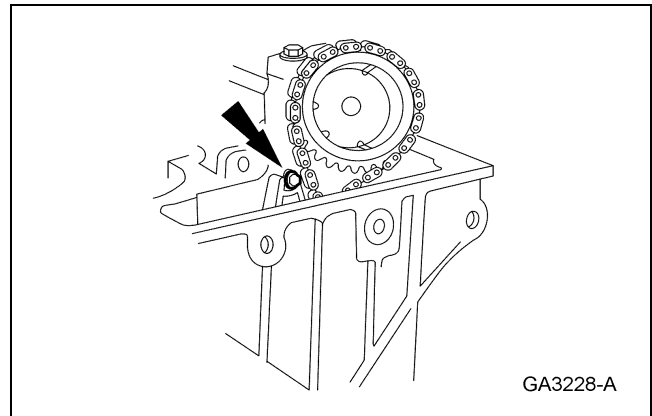
77. **CAUTION:** The camshaft sprocket must turn freely on the camshaft. **DO NOT** tighten the bolt.

Install and hand-tighten the RH rear camshaft sprocket bolt.




78. Install the RH cassette bolt.

- Tighten to 10 Nm (89 lb-in).



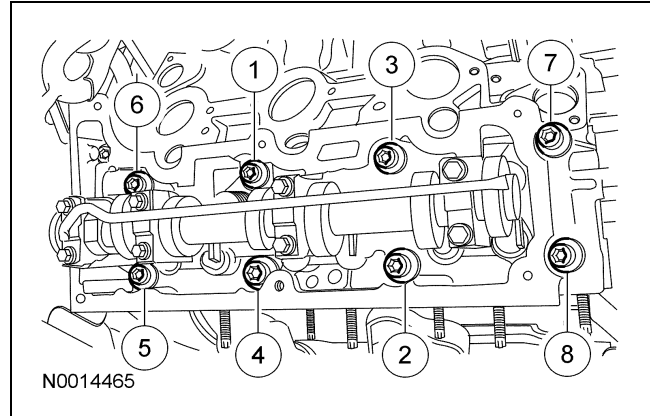
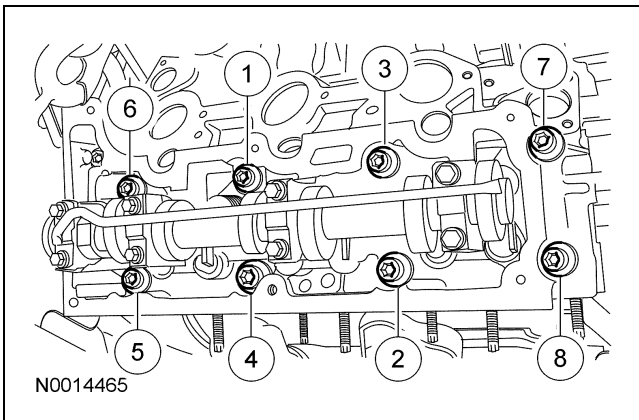
ASSEMBLY (Continued)

79.  **CAUTION:** To avoid damage to the timing chain cassette, an assistant will be required to help position the cylinder head in the vehicle.

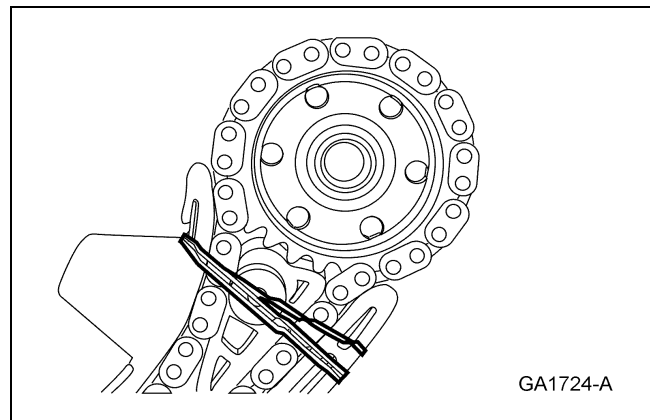
NOTE: New cylinder head bolts must be installed. They are a torque-to-yield design and cannot be reused.

Position the LH cylinder head. Install 8 new M12 bolts and tighten in the sequence shown in 2 stages.

- Stage 1: Tighten to 12 Nm (9 lb-ft).
- Stage 2: Tighten to 25 Nm (18 lb-ft).

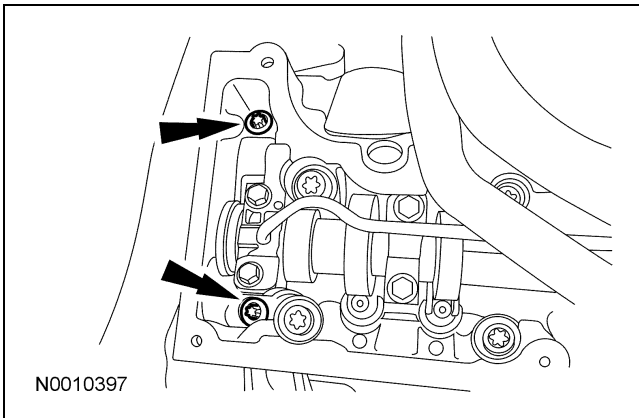



82. Position the LH cassette and camshaft sprocket.



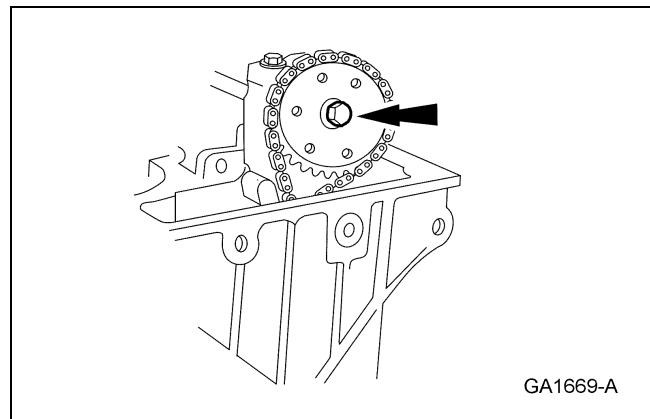
80. Install 2 new M8 bolts.

- Tighten to 32 Nm (24 lb-ft).



83.  **CAUTION:** The camshaft sprocket must turn freely on the camshaft. **DO NOT** tighten the bolt.

Install and hand-tighten the LH camshaft sprocket bolt.



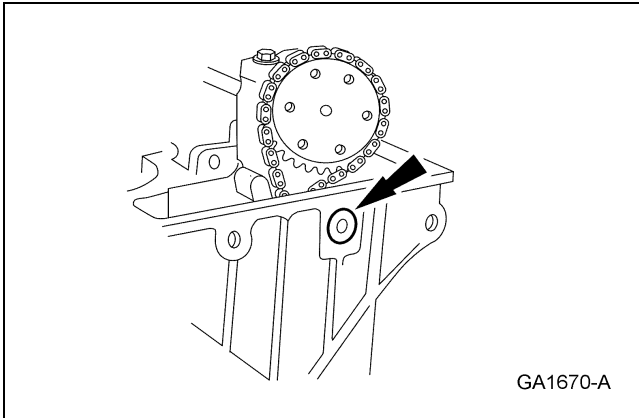
81. Tighten the 8 M12 bolts in the sequence shown in 2 stages.

- Stage 1: Tighten 90 degrees.
- Stage 2: Tighten an additional 90 degrees.

ASSEMBLY (Continued)

84. Install the LH cassette bolt.

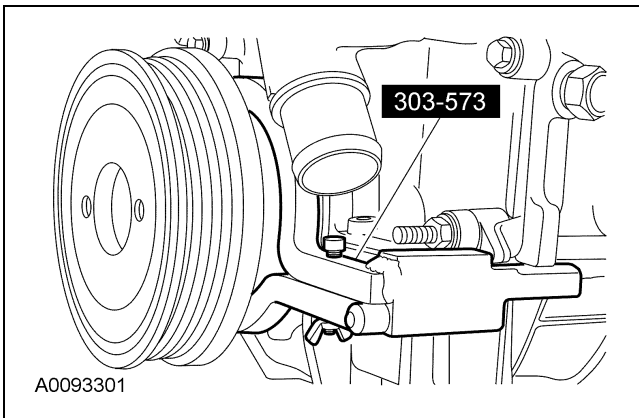
- Tighten to 12 Nm (9 lb-ft).



85. Turn the crankshaft one revolution clockwise.

86. **NOTE:** The special tool must be installed on the damper and should contact the engine block, this positions the engine at top dead center (TDC).

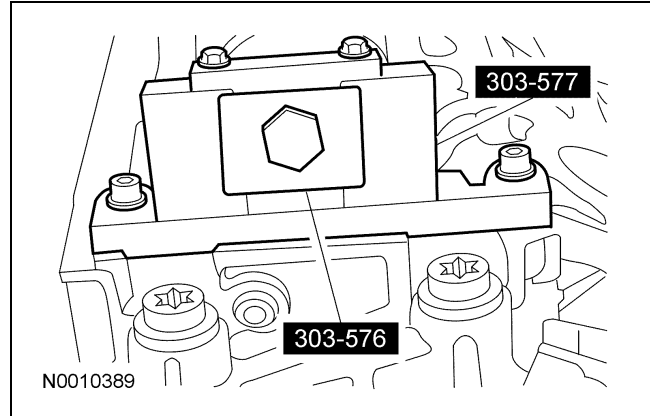
Install the special tool.



87. **NOTE:** Camshaft timing slots are off-center.

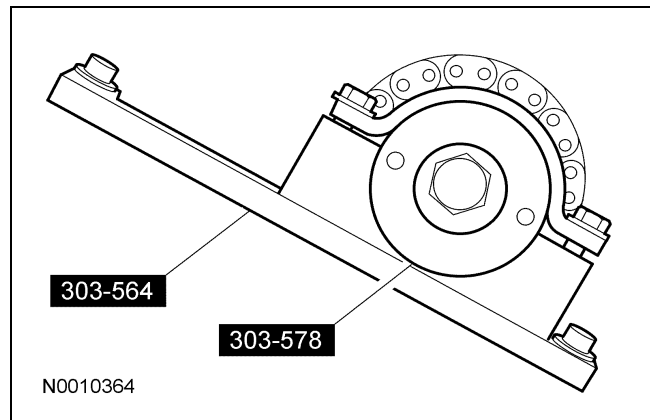
NOTE: Position the camshaft timing slots below centerline of camshaft to correctly fit the special tools.

Install the special tools on the front of the RH cylinder head.

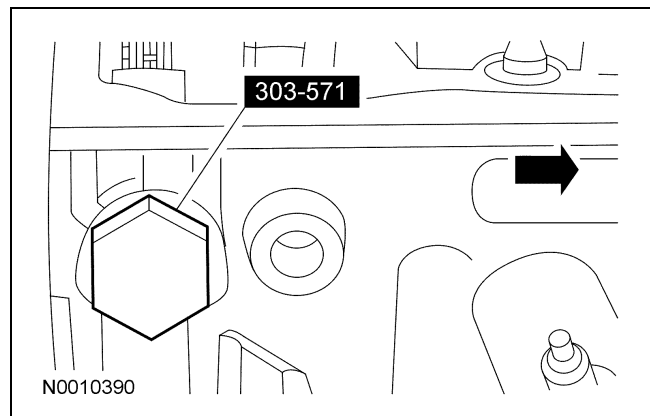


88. **NOTE:** Leave the top 2 special tool clamp bolts loose.


Install the special tools on the rear of the RH cylinder head.



89. Install the special tool.

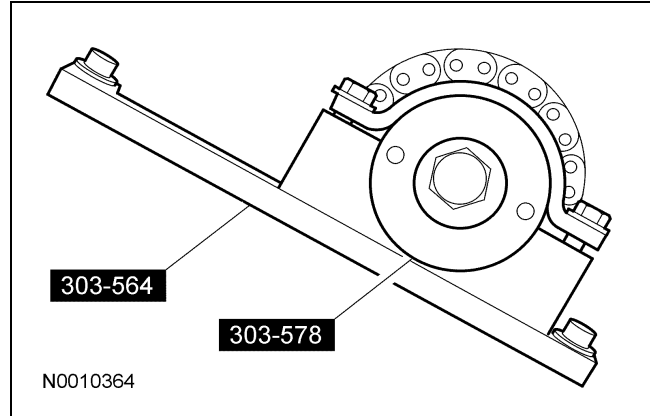
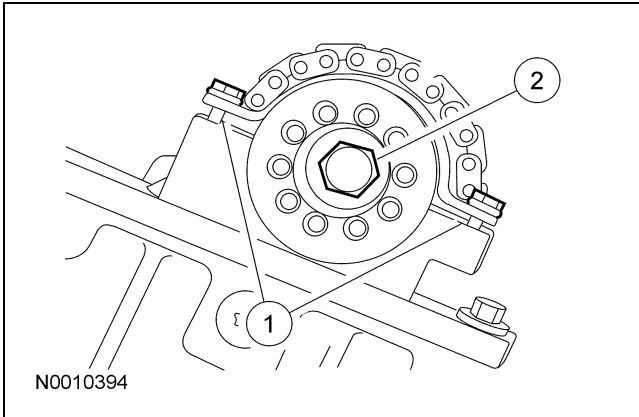


ASSEMBLY (Continued)

90.  **CAUTION:** The right-hand camshaft sprocket bolt is a left-hand threaded bolt.

Tighten the bolts.

- 1 Tighten the special tool top 2 clamp bolts to 10 Nm (89 lb-in).
- 2 Tighten the camshaft bolt to 85 Nm (63 lb-ft).



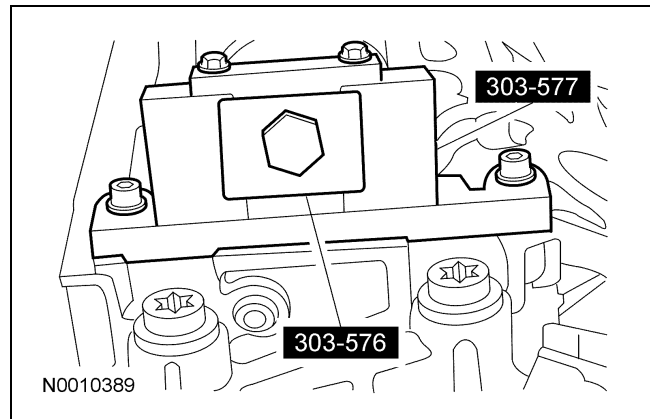
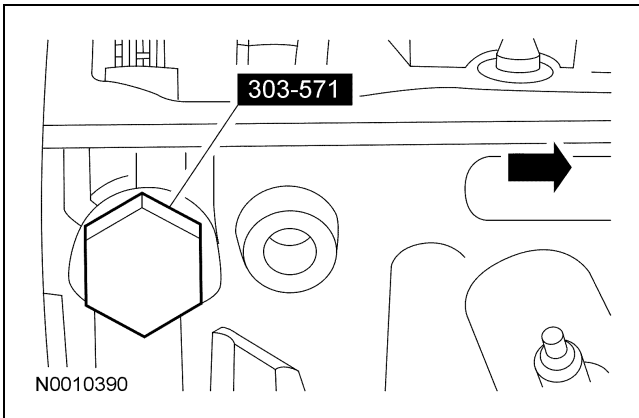
93. **NOTE:** Camshaft timing slots are off-center.

NOTE: Position the camshaft timing slots below centerline of camshaft to correctly fit the special tools.

Install the special tools on the rear of the LH cylinder head.

91. Remove the special tool and install the RH camshaft tensioner.

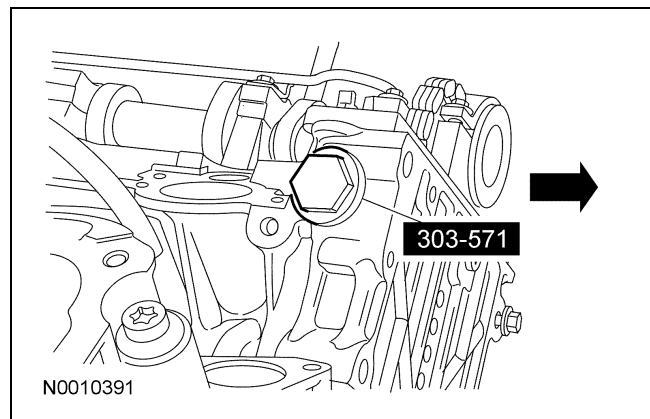
- Tighten to 44 Nm (32 lb-ft).



92. **NOTE:** Do not tighten the special tool top 2 clamp bolts. Camshaft sprocket must rotate freely.

Install the special tools on the front of the LH cylinder head.

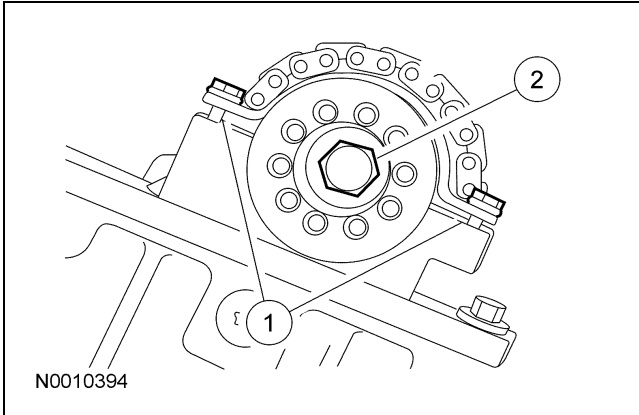
94. Install the special tool.



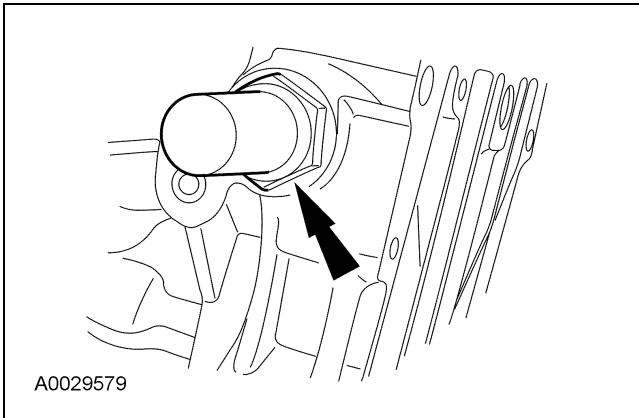
ASSEMBLY (Continued)

95. Tighten the bolts.

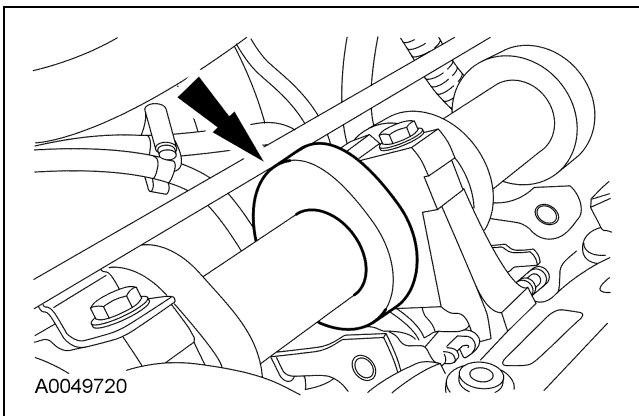
- 1 Tighten the special tool top 2 clamp bolts to 10 Nm (89 lb-in).
- 2 Tighten the camshaft bolt to 85 Nm (63 lb-ft).



96. Install the LH camshaft tensioner.

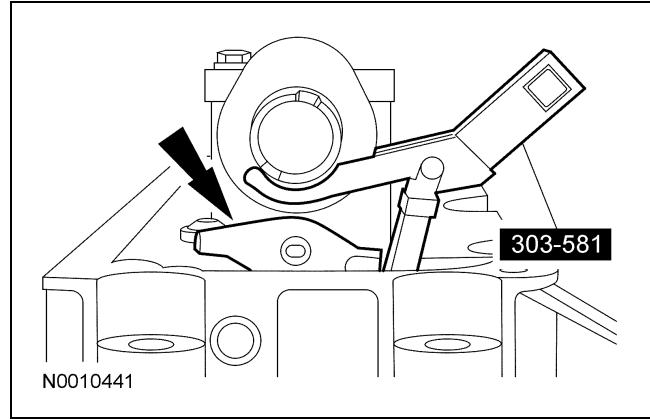


97. Rotate the crankshaft until the cam lobe is in the up position.



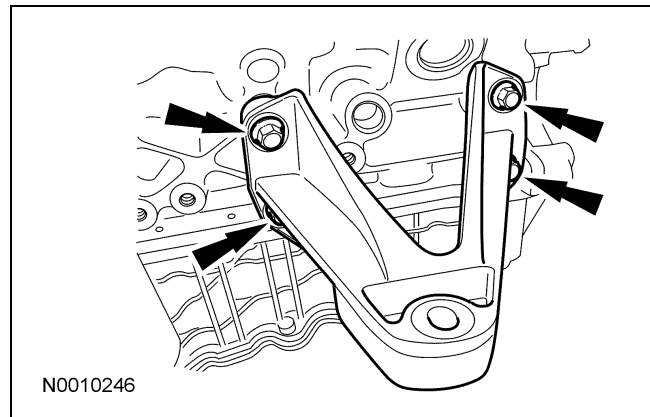
98. **NOTE:** Lubricate the roller followers with clean engine oil.

Using the special tool, install the roller followers in their original positions.



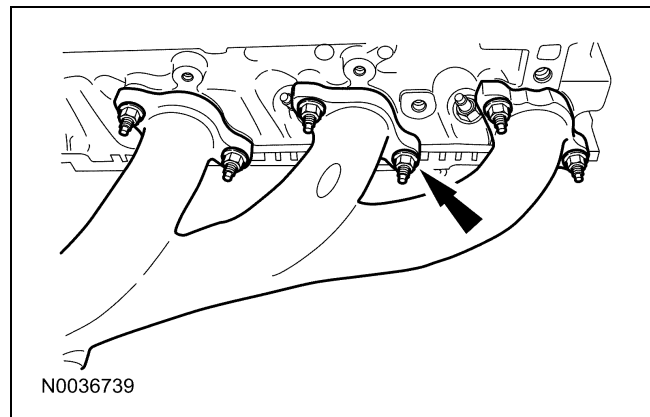
99. Position the RH engine mount bracket and install the 4 bolts.

- Tighten to 80 Nm (59 lb-ft).



100. Position a new RH exhaust manifold gasket and the RH exhaust manifold. Install the 6 nuts.

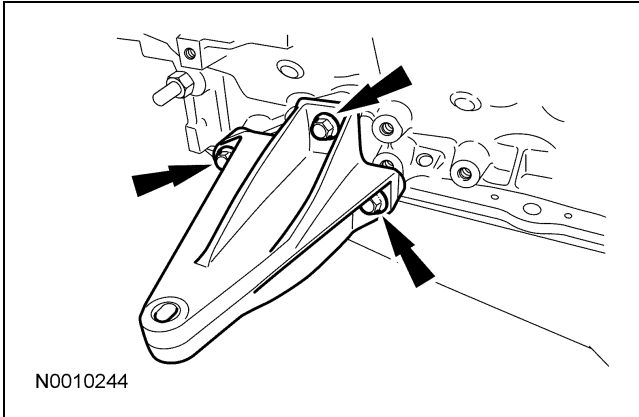
- Tighten to 23 Nm (17 lb-ft).



ASSEMBLY (Continued)

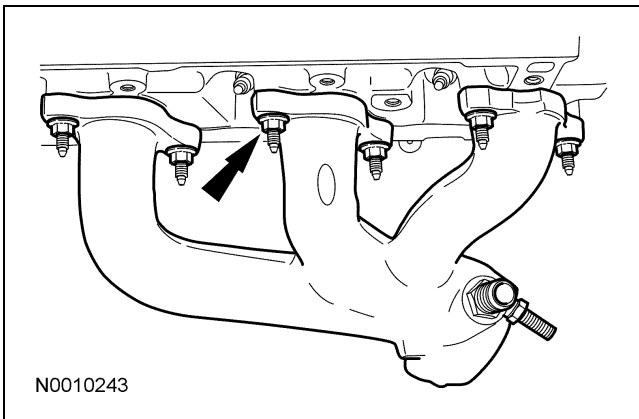
101. Position the LH engine mount bracket and install the 3 bolts.

- Tighten to 80 Nm (59 lb-ft).



102. Position a new LH exhaust manifold gasket and the LH exhaust manifold. Install the 6 nuts.

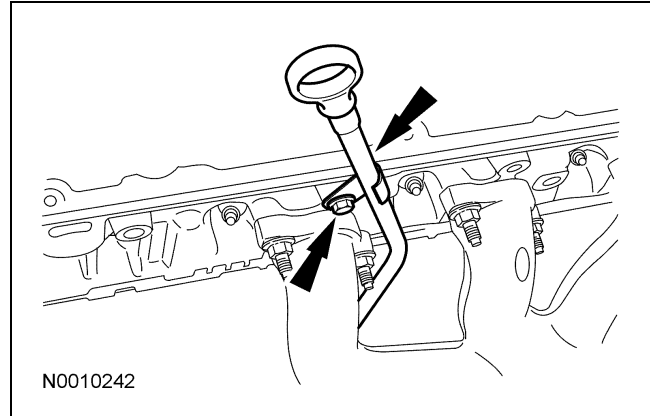
- Tighten to 23 Nm (17 lb-ft).



103. **NOTE:** Install a new O-ring seal on the oil level indicator tube and lubricate with clean engine oil.

Position the oil level indicator tube and install the bolt.

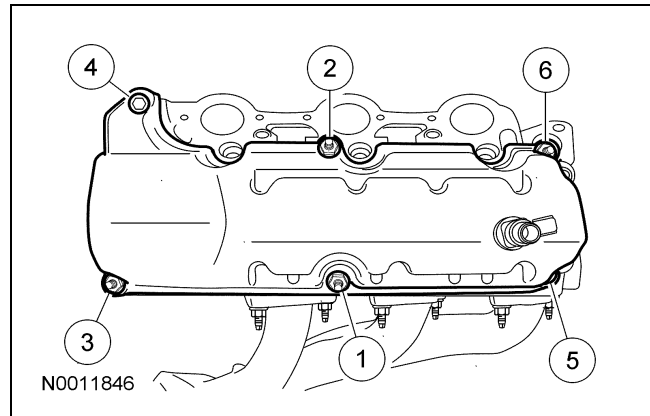
- Tighten to 11 Nm (8 lb-ft).



104. Clean the valve covers and cylinder head sealing surfaces with metal surface prep. Inspect and install new gaskets as necessary.

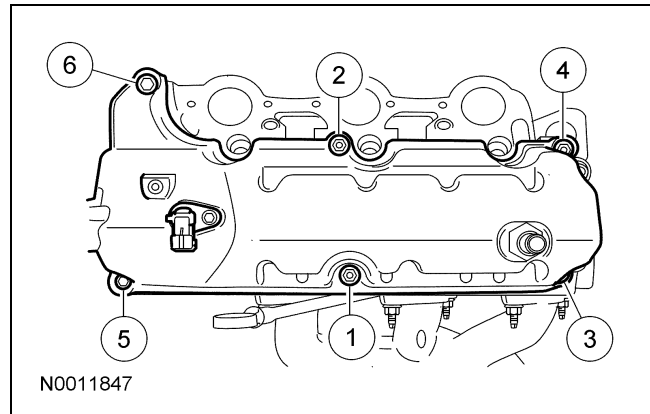
105. Position the RH valve cover and install the 2 bolts and the 4 stud bolts.

- Tighten in the sequence shown to 10 Nm (89 lb-in).



106. Position the LH valve cover and install the 3 bolts and the 3 stud bolts.

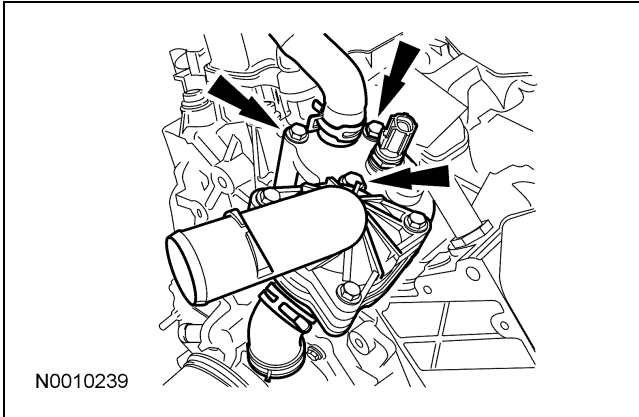
- Tighten in the sequence shown to 10 Nm (89 lb-in).



ASSEMBLY (Continued)

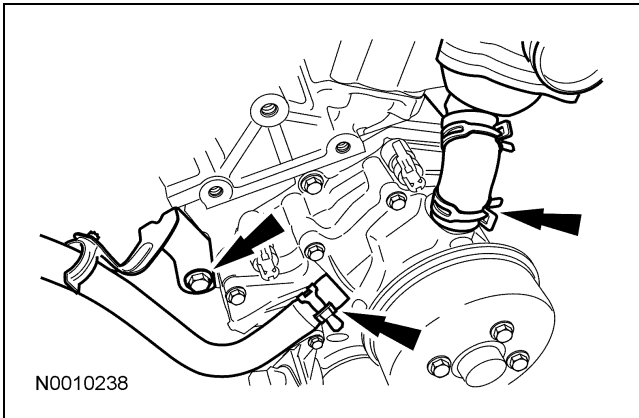
107. Position the thermostat housing, hoses and coolant tube. Install the 3 bolts.

- Tighten to 11 Nm (8 lb-ft).



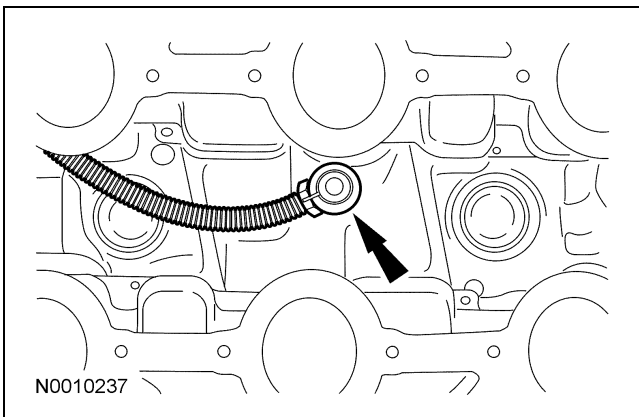
108. Connect the coolant hose to the coolant pump, position the bracket and install the bolt.


- Tighten to 45 Nm (33 lb-ft).



109. Position the knock sensor and install the bolt.

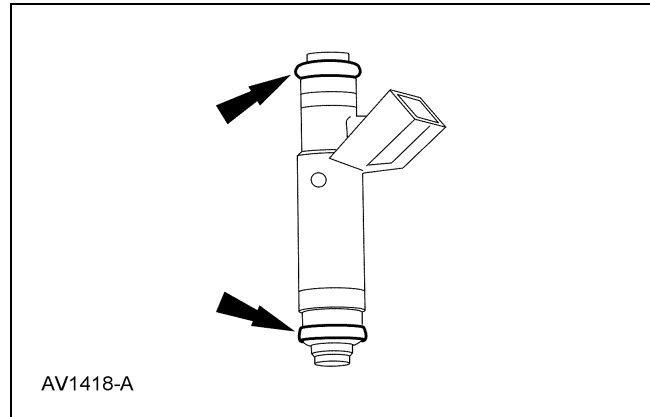
- Tighten to 20 Nm (15 lb-ft).



110.  **CAUTION:** Use O-ring seals that are made of special fuel-resistant material. Use of ordinary O-rings seals can cause the fuel system to leak. Do not reuse the O-ring seals.

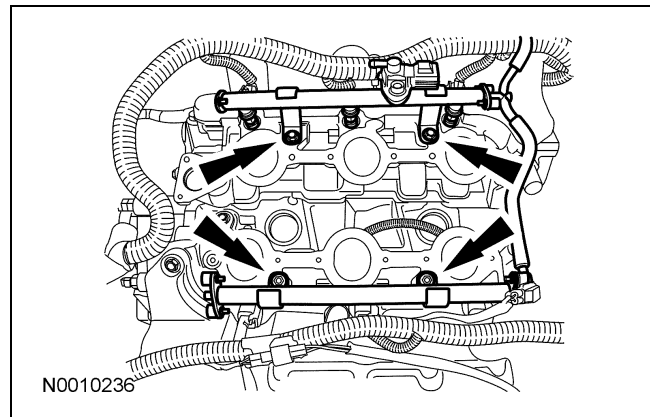
NOTE: Lubricate the O-ring seals with clean engine oil.

Install new O-ring seals on the 6 fuel injectors.



111. Position the fuel rail and injectors and install the 4 bolts.

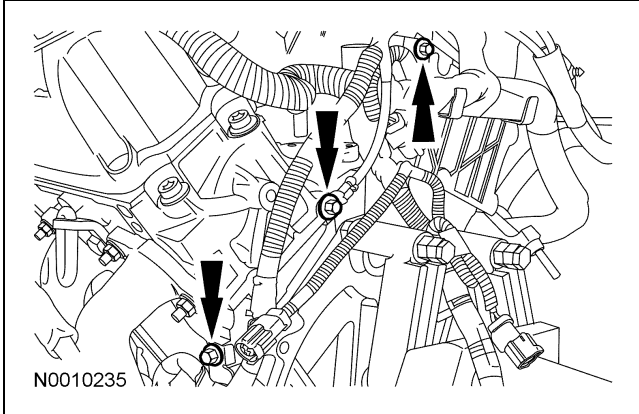
- Tighten to 23 Nm (17 lb-ft).



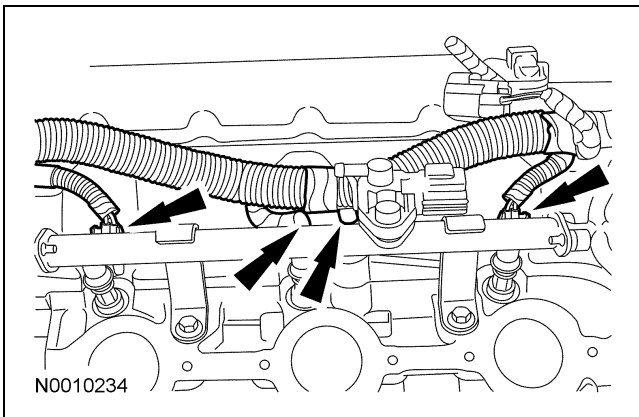
ASSEMBLY (Continued)

112. Position the main engine wiring harness on the engine and install the 3 bolts.

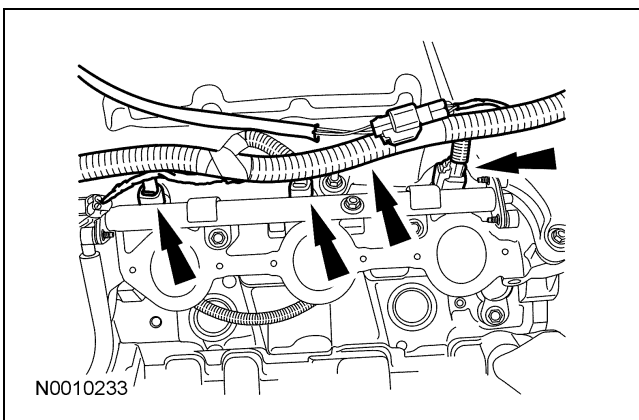
- Tighten to 40 Nm (30 lb-ft).
- Attach the wiring retainers.



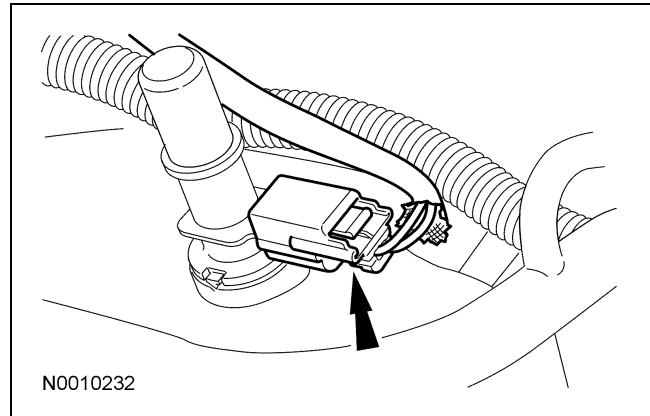
113. Connect the 3 RH fuel injector electrical connectors and attach the wiring retainer to the valve cover stud bolt.



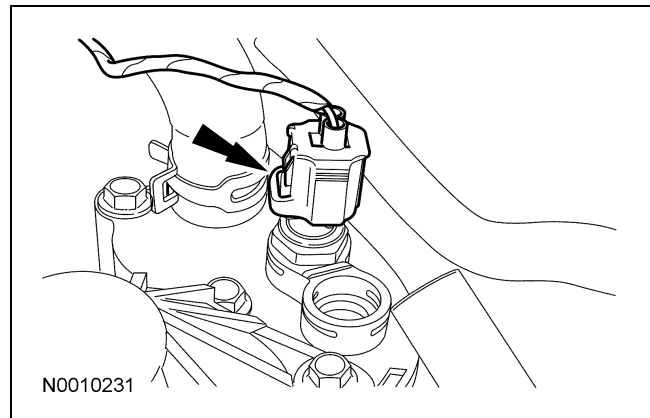
114. Connect the 3 LH fuel injector electrical connectors and attach the wiring retainer to the valve cover stud bolt.



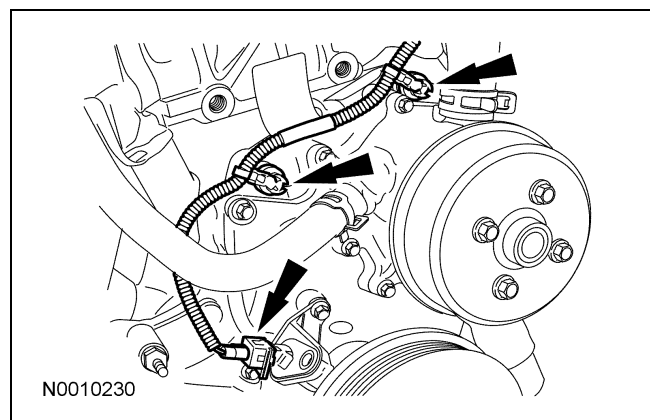
115. Connect the PCV valve electrical connector.



116. Connect the engine coolant temperature (ECT) sensor electrical connector.



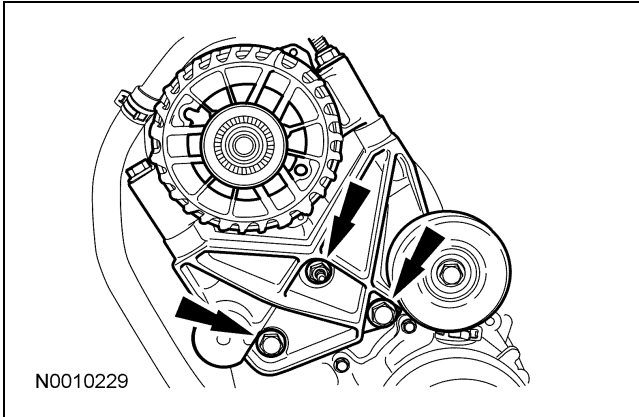
117. Connect the crankshaft position (CKP) sensor electrical connector and attach the 2 wiring retainers.



ASSEMBLY (Continued)

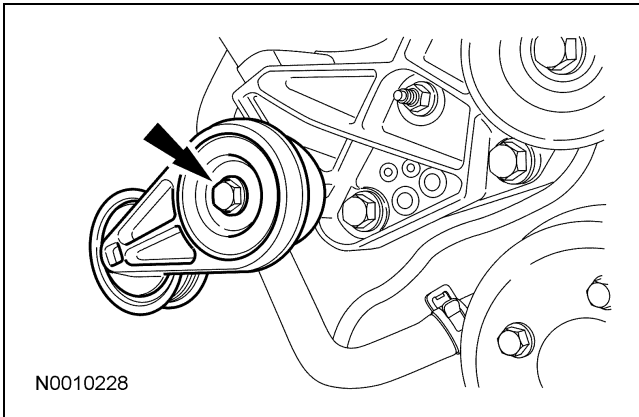
118. Position the generator and bracket. Install the 2 bolts and the nut.

- Tighten to 47 Nm (35 lb-ft).

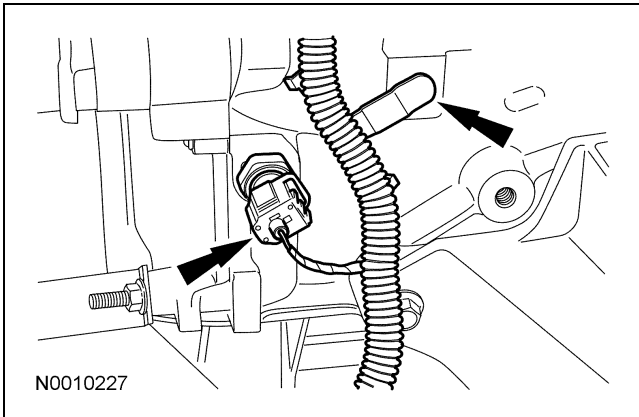


119. Install the belt tensioner and the bolt.

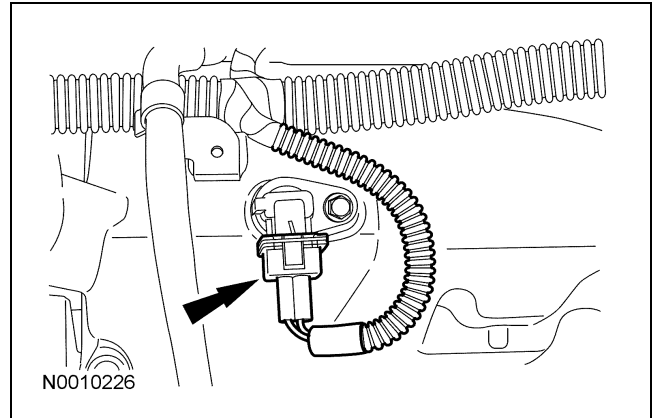
- Tighten to 47 Nm (35 lb-ft).



120. Connect the oil pressure sensor electrical connector and attach the wiring retainer.

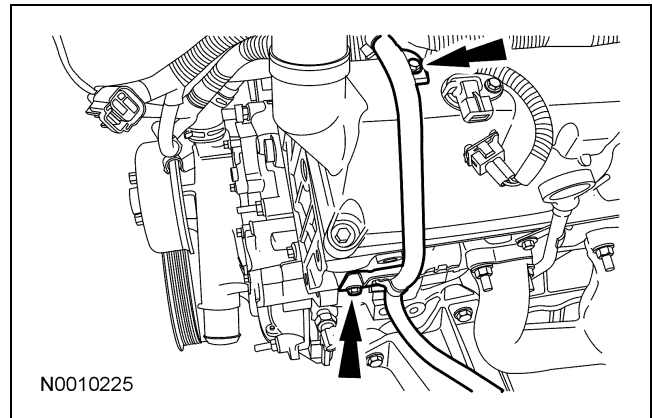


121. Connect the camshaft position (CMP) electrical connector.



122. Position the fuel rail supply tube brackets and install the 2 bolts.

- Tighten the bolt for the upper bracket to 6 Nm (53 lb-in).
- Tighten the bolt for the lower bracket to 10 Nm (89 lb-in).

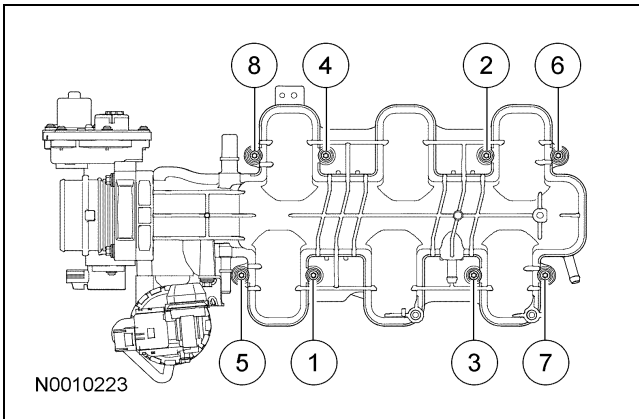


ASSEMBLY (Continued)

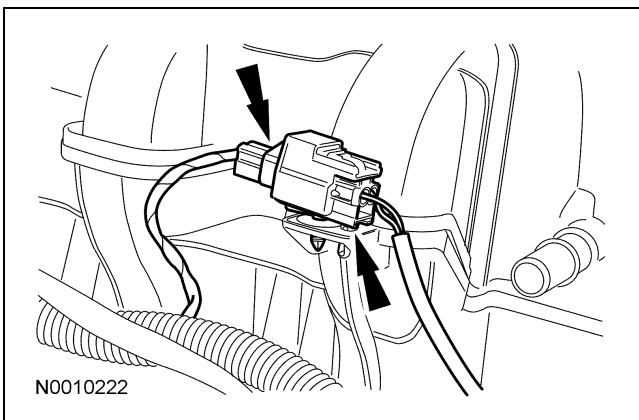
123. **NOTE:** Clean and inspect all sealing surfaces. Inspect and install new intake manifold gaskets as necessary.

Position the intake manifold and install the 8 bolts.

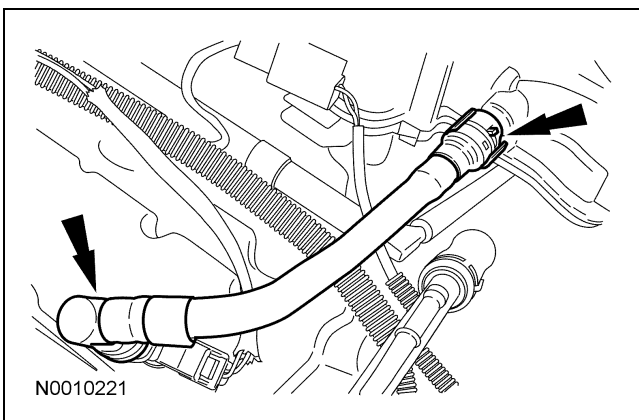
- Tighten in the sequence shown to 10 Nm (89 lb-in).



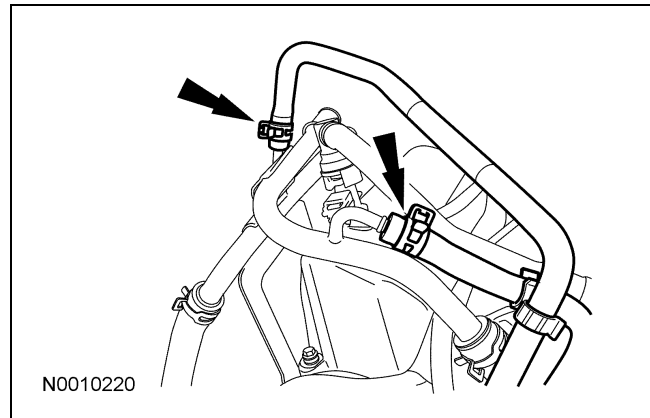
124. Connect the KS electrical connector and attach the wiring retainer.



125. Install the PCV tube.

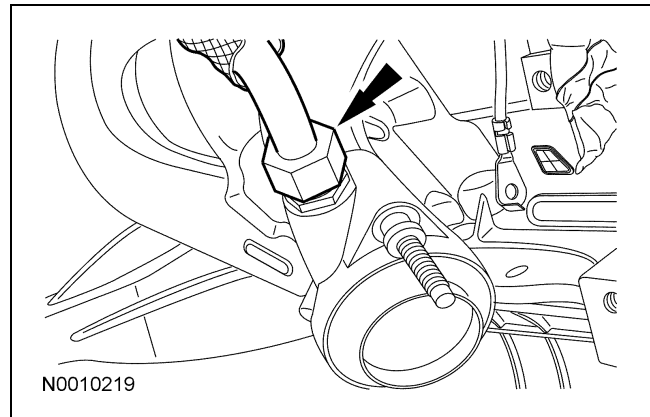


126. Connect the 2 throttle body coolant hoses to the coolant tube.



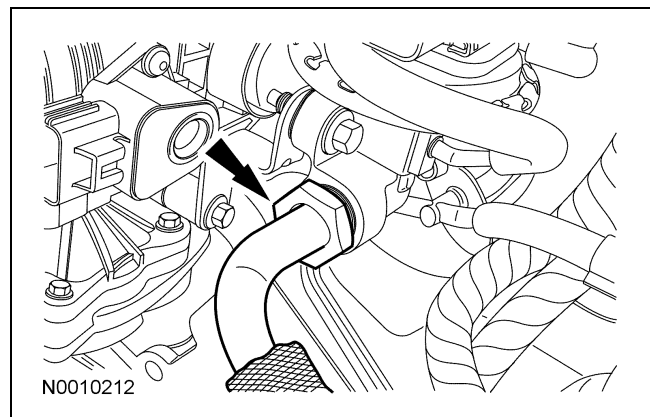
127. Position the exhaust gas recirculation (EGR) tube. Connect the fitting to the LH exhaust manifold.

- Tighten to 39 Nm (29 lb-ft).



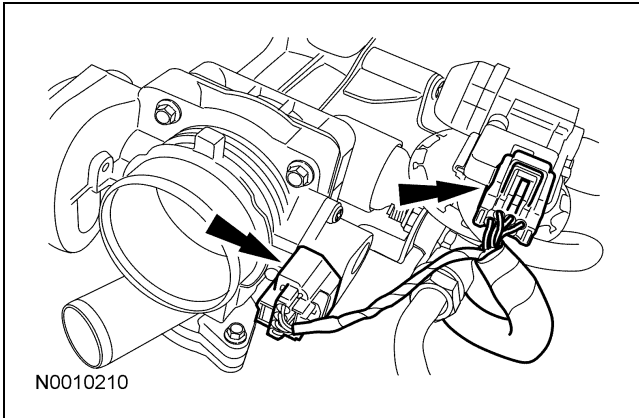
128. Connect the EGR tube fitting to the EGR system module.

- Tighten to 39 Nm (29 lb-ft).

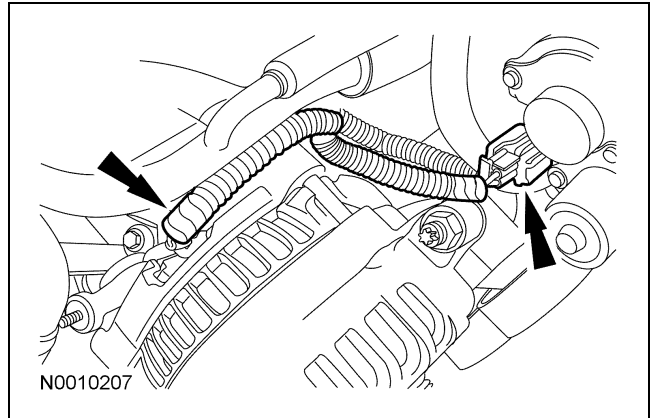


ASSEMBLY (Continued)

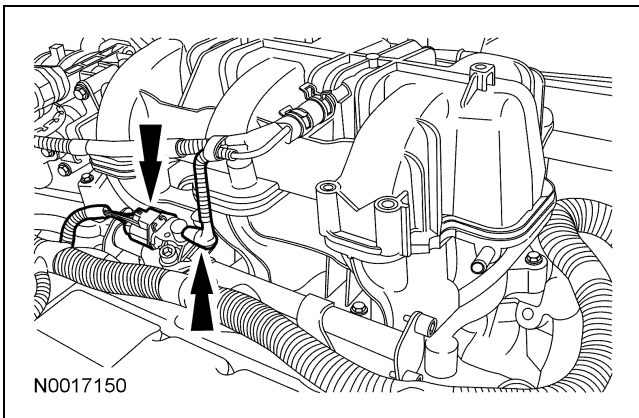
129. Connect the EGR system module and throttle position (TP) sensor electrical connectors.



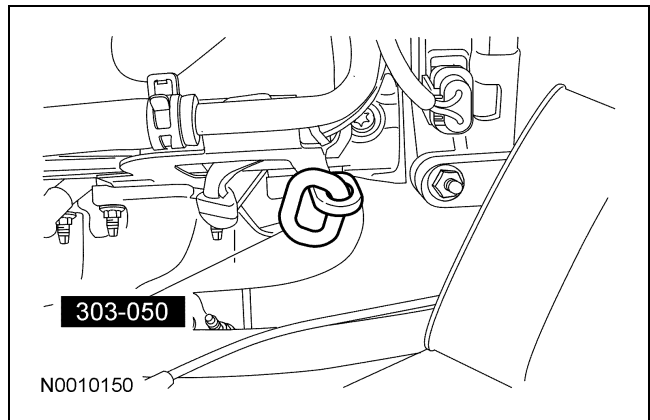
132. Connect the generator and throttle body electrical connectors.



130. Connect the fuel rail pressure and temperature sensor electrical connector and the vacuum tube.

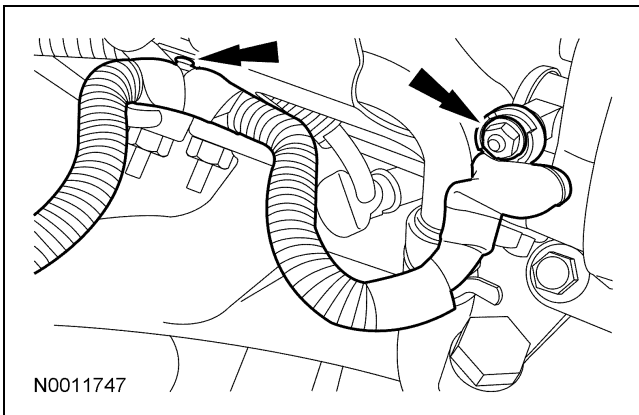


133. Install the special tool to the RH cylinder head.

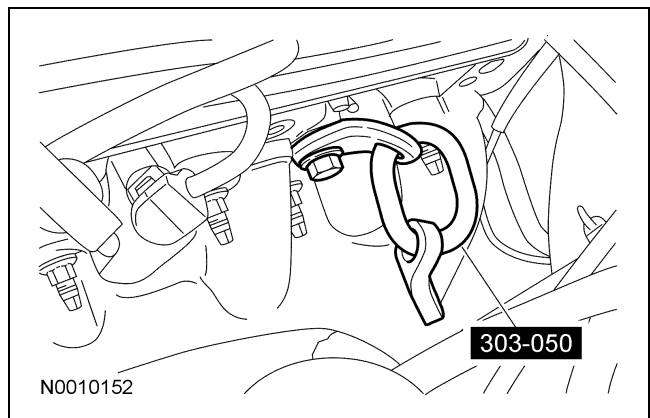


131. Attach the B+ terminal to the generator and install the nut.

- Tighten to 8 Nm (71 lb-in).
- Attach the wiring retainer to the generator.

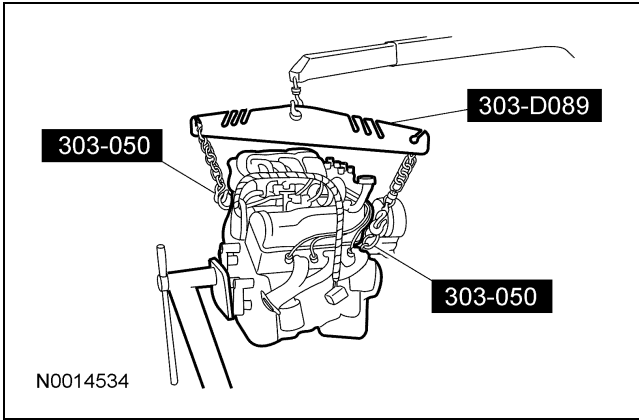


134. Install the special tool to the LH cylinder head.

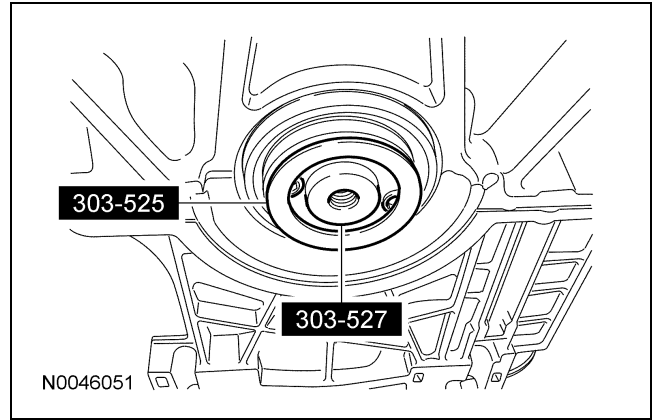


ASSEMBLY (Continued)

135. Using the special tools, remove the engine from the engine stand.



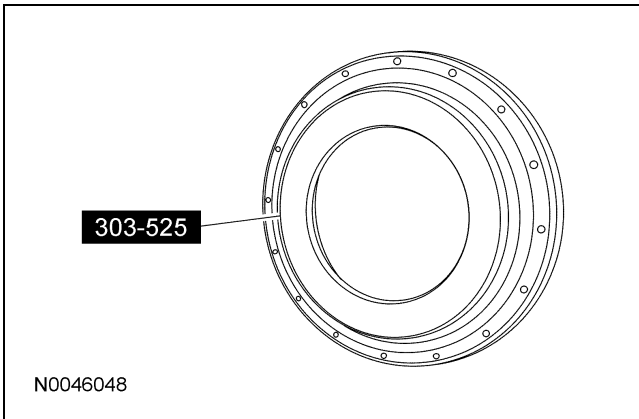
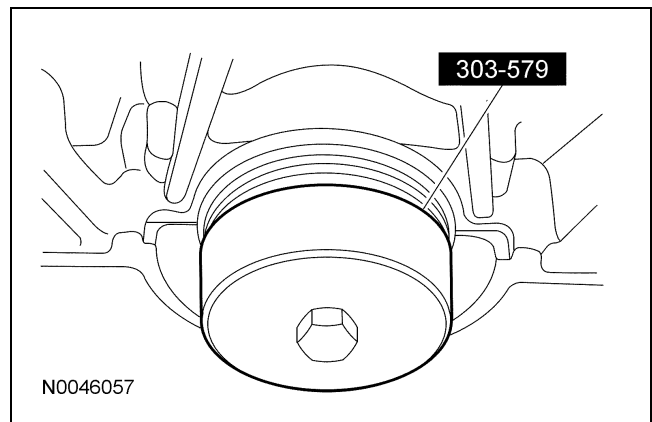
138. Position the crankshaft rear oil seal and the special tool.



136. **NOTE:** Be sure the crankshaft rear sealing surface is clean and free from any rust or corrosion. To clean the crankshaft rear seal surface area, use extra-fine emery cloth or extra-fine 0000 steel wool with metal surface prep.

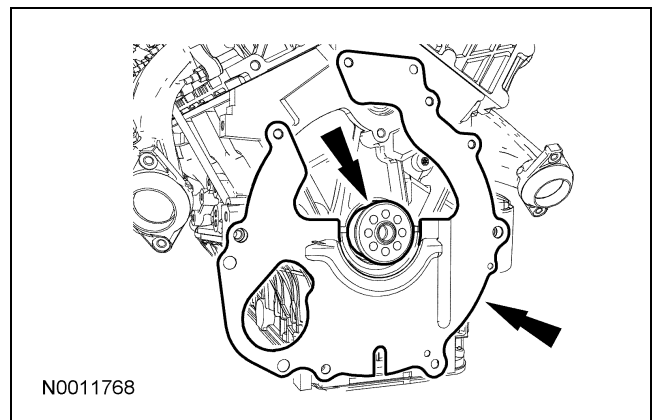
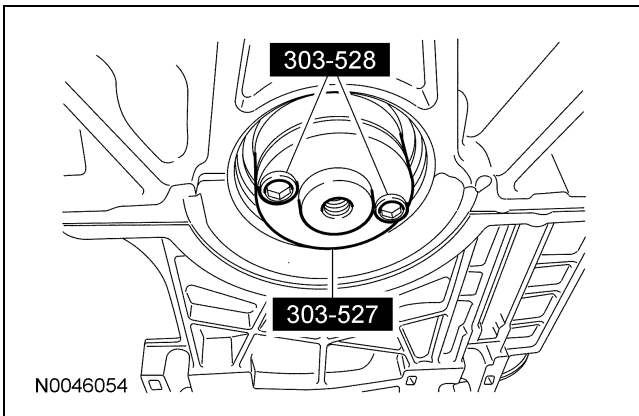
Lubricate the crankshaft rear oil seal with clean engine oil and install it on the special tool.

139. Using the special tool, install the crankshaft rear oil seal.



140. Install the spacer plate and if equipped, the flexplate-to-crankshaft spacer.

137. Install the special tools.



ASSEMBLY (Continued)

141. **NOTE:** Special bolts are used for flexplate and flywheel installation. Do not use standard bolts.

Install the flexplate or flywheel.

- Tighten the bolts in the sequence shown in 2 stages.
 - Stage 1: Tighten to 13 Nm (10 lb-ft).
 - Stage 2: Tighten to 71 Nm (52 lb-ft).

